We report the capacitive behavior of electrochemically polymerized polyazulene films in different ionic liquids. The ionic liquids in this study represent conventional imidazolium based ionic liquids with tetrafluoroborate and bis(trifluoromethylsulfonyl)imide anions as well as an unconventional choline based ionic liquid. The effect of different ionic liquids on the polymerization and capacitive performance of polyazulene films is demonstrated by cyclic voltammetry and electrochemical impedance spectroscopy in a 3-electrode cell configuration. The films exhibit the highest capacitances in the lowest viscosity ionic liquid (92 mF cm⁻²), while synthesis in high viscosity ionic liquid shortens the conjugation length and results in lower electroactivity (25 mF cm⁻²). The obtained films also show good cycling stabilities retaining over 90% of their initial capacitance over 1200 p-doping cycles. We also demonstrate, for the first time, flexible polyazulene supercapacitors of symmetric and asymmetric configurations using the choline based ionic liquid as electrolyte. In asymmetric configuration, capacitance of 55 mF (27 mF cm⁻²) with an equivalent series resistance of 19 Ω is obtained at operating voltage of 1.5 V. Upon increasing the operating voltage up to 2.4 V, the capacitance increases to 72 mF (36 mF cm⁻²).
Pyrolysed cellulose nanofibrils and dandelion pappus in supercapacitor application

Dandelion pappus and wood based nanocellulose fibrils were combined to form films that were subsequently pyrolyzed under low-pressure conditions in a carbon monoxide (CO) rich atmosphere to make supercapacitor electrode material. The electrodes were prepared from these materials and pyrolyzed under low-pressure conditions in a carbon monoxide-rich atmosphere. The electrode materials and assembled supercapacitors were electrically and structurally characterized. The assembled six supercapacitors showed specific capacitances per electrode ranging from 1 to 6 F/g and surface resistance of pyrolyzed electrodes ranging from 30 to 170 Ω/□. Finally, equivalent series resistance and leakage current measurements were conducted for three samples, resulting values from 125 to 500 Ω and from 0.5 to 5.5 µA, respectively.

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Engineering and Characterization of Bacterial Nanocellulose Films as Low Cost and Flexible Sensor Material

Some bacterial strains such as Komagataeibacter xylinus are able to produce cellulose as an extracellular matrix. In comparison to wood-based cellulose, bacterial cellulose (BC) holds interesting properties such as biodegradability, high purity, water-holding capacity, and superior mechanical and structural properties. Aiming toward improvement in BC
production titer and tailored alterations to the BC film, we engineered K. xylinus to overexpress partial and complete bacterial cellulose synthase operon that encodes activities for BC production. The changes in cell growth, end metabolite, and BC production titers from the engineered strains were compared with the wild-type K. xylinus. Although there were no significant differences between the growth of wild-type and engineered strains, the engineered K. xylinus strains demonstrated faster BC production, generating 2–4-fold higher production titer (the highest observed titer was obtained with K. xylinus-bcsABCD strain producing 4.3 ± 0.46 g/L BC in 4 days). The mechanical and structural characteristics of cellulose produced from the wild-type and engineered K. xylinus strains were analyzed with a stylus profilometer, in-house built tensile strength measurement system, a scanning electron microscope, and an X-ray diffractometer. Results from the profilometer indicated that the engineered K. xylinus strains produced thicker BC films (wild type, 5.1 μm, and engineered K. xylinus strains, 6.2–10.2 μm). Scanning electron microscope revealed no principal differences in the structure of the different type BC films. The crystallinity index of all films was high (from 88.6 to 97.5%). All BC films showed significant piezoelectric response (5.0–20 pC/N), indicating BC as a promising sensor material.

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### Computing Platforms for Software-Defined Radio
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Authors: Hussain, W., Nurmi, J., Isoaho, J., Garzia, F.
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ASJC Scopus subject areas: Electrical and Electronic Engineering
Conclusions
Navigation and localization are nowadays an intrinsic part of the majority of wireless communication devices. They are also likely to play crucial roles in the new generations of communication devices, such as Device-to-Device (D2D), Internet of Things (IoT) and 5G.

Design and Implementation of IEEE 802.11a/g Receiver Blocks on a Coarse-Grained Reconfigurable Array
This chapter presents the design and evaluation of template-based Coarse-Grained Reconfigurable Array (CGRA) generated accelerators that process Orthogonal Frequency-Division Multiplexing receiver blocks. The CGRA operates as a coprocessor with a Reduced Instruction-Set Computing (RISC) processor so that the overall system yields the benefits of general- and special-purpose processing. The accelerators are designed by crafting the CGRA template to the computational and communication requirements of the algorithms in an effort to minimize the resource utilization and power dissipation on the target Field Programmable Gate Array (FPGA) device. The performance of each CGRA is recorded in terms of the number of clock cycles and several multiple performance metrics. The power consumption is also estimated by simulating the postfit gate-level FPGA netlist of the accelerators.
Design Transformation from a Single-Core to a Multi-Core Architecture Targeting Massively Parallel Signal Processing Algorithms

This chapter describes single-core and multi-core platforms that are reconfigurable and heterogeneous by design and are specifically targeted to accelerate computationally intensive signal processing algorithms mostly used in software-designed radio applications. The signal-core accelerator architectures are tightly integrated with a C programmable processor core while the backbone of communications and control in multi-core architecture is a network-on-chip. The platforms were instantiated multiple times for different proof-of-concept application scenarios. The single- and multi-core platforms were subjected to self-aware dynamic frequency scaling while being prototyped for a field programmable gate array device. The performance of the platforms was measured and estimated in terms of many basic and high-level metrics and comparisons with other state-of-the-art platform are established for design evaluation.

Introduction and Book Structure

Wireless positioning and navigation area is a prevalent area embroidered in the majority of wireless communication devices and applications. The number of technologies supporting wireless navigation has been continuously increasing in the last decade, from those based on classical satellite navigation systems to technologies employing inertial sensors, Wireless Local Area Networks (WLAN) and cellular systems, and even ultra-sound and visible light systems.

Mapping the Radio World to Find Us

Locating users in an indoor scenario is a challenging task. While there are several systems capable of tackling it, most of them are impractical to deploy in a worldwide scale due to the costs associated with its infrastructure. Therefore, this chapter guides the reader through a popular indoor positioning technique, fingerprinting, which relies on existing infrastructure to provide an estimation of the user's location. While any kind of signal can be used, such as acoustic and electromagnetic signals, the focus is put on wireless local area network signals, which are ubiquitous in most current buildings. Along the way, the chapter introduces path-loss models, advantages, disadvantages and a thorough description of the installation and performance characteristics of the proposed approach.
of the inner workings of this technique.

Multi-GNSS: Facts and Issues
The world of satellite navigation is experiencing an era of expansion, as the GNSS community is growing. Besides the two already operational systems, the United States of America’s GPS and Russia’s GLONASS, two additional constellations are currently under development and near to be completed: the Chinese BeiDou and the European Galileo. Within 2020, four systems are then expected to be fully operational and will offer immense possibilities to improve navigation performance in terms of availability, continuity, reliability and accuracy. This chapter focuses on current and future GNSS, giving an introduction to each system and pointing out advantages and challenges of the multi-constellation scenario.

MULTI-POS: Lessons Learnt from Fellows and Supervisors
The path to a successful and cooperative network is not always smooth. Marie Curie networks are, by definition, networks of people with various technical and cultural backgrounds and with different personalities, individual work and life targets, and personal ways of solving the challenges that each has to cope with. The larger a network is, the more likely it is that some conflicts or personality mismatches appear, but this is not necessarily a bad thing, and it can be used as a learning and growth lesson. This chapter addresses the various challenges that were encountered during the MULTI-POS implementation and it summarizes the lessons learnt by both the fellows and the supervisors. The goal of this chapter is to offer some generic guidelines in forming and running large international networks, such as the Marie Curie training networks, and to enable the people interested in such collaborations to pro-actively identify and tackle some of the inherent challenges in such networks.
MULTI-POS: Multi-Technology Positioning Professionals Training Network
This chapter presents an overview of the Marie Curie Initial Training Network MULTI-POS, whose fellows are the main authors of the rest of the book chapters. The motivation of creating this network is first presented, and then the network structure and some of its main realizations are overviewed.

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Authors: Lohan, E., Nurmi, J., Wymeersch, H., Nykänen, O., Seco-Granados, G.
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Ninesilica: A Homogeneous MPSoC Approach for SDR Platforms

This chapter presents the study of Software Defined Radio applications on homogeneous multi-core architectures based on the Silicon Café template. Two instances of the template have been realized and implemented on an Altera Stratix IV FPGA device. Ninesilica, the first instance of the template, is a homogeneous 3 x 3 mesh of processing elements realizing a standalone cluster. The second instance of the template is a clustered architecture composed of four Ninesilica clusters. Significant kernels of WCDMA and OFDM kernels were ported on the architectures analyzing the platform performance in terms of computational power, algorithm scalability, energy consumption and efficiency, portability of the mapping and hardware scalability. The achieved results showed that the proposed approach offers a high flexibility and parallelization efficiency, making homogeneous solutions a good candidate for the implementation of SDR systems.

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Authors: Airoldi, R., Garzia, F., Ahonen, T., Nurmi, J.
Pages: 107-119
Publication date: 2017

Synchronization in NC-OFDM-Based Cognitive Radio Platforms

This chapter provides essential information with regard to the synchronization issues in Non-Contiguous Orthogonal Frequency Division Multiplexing (NC-OFDM)-based systems. It also provides a flexible timing synchronization scheme implemented on an Altera Stratix-V Field Programmable Gate Array (FPGA) device. The main component of the synchronizer is a reconfigurable module which calculates the Sum-of-Products (SoP) of the incoming signal with predefined coefficients. The SoP module performs as a multicorrelator on demand. Furthermore, different architectures of the SoP block and their respective performance evaluations are discussed in detail. Eventually, all developed architectures are compared to each other in terms of power consumption, silicon area, maximum frequency, etc.

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Authors: Shamani, F., Ahonen, T., Nurmi, J.
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The Evolution of Software-Defined Radio: An Introduction

The Software-Defined Radio (SDR) concept was originally developed by the combined efforts of various research groups in the private and government organizations of the United States (US) in 1970s–1980s. The important ones to mention are the US Department of Defense Laboratory and a team at the Garland, Texas Division of E-Systems Inc. In 1991, Joe Mitola independently reinvented the term 'Software Radio' (SR) in cooperation with E-Systems as a plan to build a true software-based GSM transceiver (Mitola, Telesystems Conference, 1992). The SR platform essentially processes almost
all the transceiver algorithms as software for a processor. This includes nearly all layers of transmission. However, an optimal implementation of physical layer is always challenging due to an enormous amount of mathematical computation. Over the period of time, many developmental changes occurred and an interesting feature of cognition was added to existing SDR platforms, thereby inventing the term ‘Cognitive Radio’. The main idea was to reduce over-sampling by the analog to digital converter, reduce on-chip processing and to target only the spectrum of interest. This book also touches the CR feature in the large SDR field in some of its selected chapters. Since, the very first few articles of J. Mitola, there has been a tremendous amount of research work conducted in industry and academia. The evolution in SDRs is continuous with time and provides a number of excellent opportunities to researcher for exploration and to come up with their findings. The present day SDR implementations are such that the designers are focused mostly on the design of hardware and software, their interfacing and optimizations for varying architectural choices. It includes multiple cases of application-specific general-purpose acceleration platforms that are scalable, homogeneous and heterogeneous in nature while providing multiple programmable cores on a single chip computing system.

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The Future of Software-Defined Radio: Recommendations
An efficient Software-Defined Radio solution comes when all the aspects of system design are collectively addressed under application specifications and constraints. It includes all—the efforts to design wideband antennas, powerful software to process huge bandwidth of information, optimizations at hardware to maximize performance and nevertheless to mention compilers and operating systems. It is important that every engineer or a scientist working on a particular block of SDR should have a bare-minimum understanding of the entire design stack. There is a need to have clear vision about the targets to be achieved, trade-offs to be made, and a unified approach so that all the objectives are measurable to enable a qualitative and quantitative analysis.

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Understanding the GNSS Signal Model
The aim of this chapter is to guide anyone who is new to the Global Navigation Satellite System (GNSS) field through the basics of navigation signal modelling. The chapter explains the relation between the mathematical model and physical reality. It reveals some basic facts which are usually hidden in an advanced literature on signal processing in GNSS. In
detail, it focuses on the noise modelling and it provides a recipe to properly set the noise level in a computer simulation to authentically reflect the real situation. It also provides an explanation of the Doppler effect and it discusses its overall impact on the received navigation signal.

**Fast-convolution filtered OFDM waveforms with adjustable CP length**

This paper investigates the application of flexible and effective fast-convolution (FC) filtering scheme for multiplexing OFDM physical resource blocks (PRBs) in a spectrally well-localized manner. The scheme is able to suppress interference leakage between adjacent PRBs, thus supporting independent waveform parametrization for different PRBs, as well as asynchronous multiuser operation. These are considered as important features in the 5G waveform development. This contribution focuses on the parametrization alternatives and constraints, which are mostly due to the forward and inverse discrete Fourier transform (DFT/IDFT) lengths feasible for practical implementation. Special attention is on cyclic prefix (CP) OFDM system dimensioning with adjustable CP length while the overall symbol duration is fixed. It is demonstrated that a wide range of alternative CP-lengths are usually available through the FC-filtered OFDM scheme.

**Integration Issues of a run-Time Configurable Memory Management Unit to a RISC Processor on FPGA**

This paper presents the integration issues of a proposed run-time configurable Memory Management Unit (MMU) to the COFFEE processor developed by our group at Tampere University of Technology. The MMU consists of three Translation Lookaside Buffers (TLBs) in two levels of hierarchy. The MMU and its respective integration to the processor is prototyped on a Field Programmable Gate Array (FPGA) device. Furthermore, analytical results of scaling the second-level Unified TLB (UTLB) to three configurations (with 16, 32, and 64 entries) with respect to the effect on overall hit rate as well as the energy consumption are shown. The critical path analysis of the logical design running on the target FPGA is presented together with a description of optimization techniques to improve static timing performance which leads to gain 22.75% speed-up. We could reach to our target operating frequency of 200 MHz for the 64-entry UTLB and, thus, it is our preferred option. The 32-entry UTLB configuration provides a decent trade-off for resource-constrained or speed-critical hardware designs while the 16-entry configuration poses unsatisfactory performance. Next, integration challenges and how to resolve each of them (such as employing a wrapper around the MMU, modifying the hardware description of the COFFEE core, etc.) are investigated in detail. This paper not only provides invaluable information with regard to the implementation and integration phases of the MMU to a RISC processor, it opens a new horizon to our processor to provide virtual memory for its running operating system without degrading the operating frequency. This work also tends
toward being a general reference for future integration to the COFFEE core as well as other similar processor architectures.

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**FPGA Implementation Issues of a Flexible Synchronizer Suitable for NC-OFDM-Based Cognitive Radios**

This paper presents a flexible timing synchronization scheme alongside the hardware implementation issues on an Altera Stratix-V Field Programmable Gate Array (FPGA) device. The core content of the synchronizer is based on Finite Impulse Response (FIR) filter which operates as a multicorrelator on demand. The term "flexibility" refers to a specific part of the synchronizer where the multicorrelator reconfigures its FIR filter block on-the-fly by employing Partial Reconfiguration (PR) feature. Moreover, different implementations have been evaluated for the multicorrelator, including MultiplierLess (ML) approach (an approximate computing technique only for autocorrelation purpose) along with the Direct From as well as the Transposed, Parallel, and Pipelined-Parallel Direct Form FIR filters. All the developed architectures are compared to each other in terms of power consumption, silicon area, and maximum frequency. Preliminary synthesis results show that the ML approach achieves better performance (including 94% less power dissipation, 75% less logic utilization as well as 67% fewer registers) than other architectures when performing autocorrelation function. Furthermore, the critical path is analyzed and appropriate optimization techniques (such as DSP register packing and intermediate register insertion) are applied to the best candidates of the architectures mentioned. As the best results, 2.83× speed-up, 56.57% less logic utilization along with 38.86% fewer registers are achieved for different architectures. Accordingly, we discover that the parallel form, as well as the pipelined-parallel one, achieve more interesting results than the transposed version in most of the cases.
Using OpenCL to Rapidly Prototype FPGA Designs

Field Programmable Gate Arrays (FPGAs) have gained popularity because their reconfigurability can speed up development and verification with relatively low cost. However, the deep level of understanding required on hardware logic programming has discouraged many software engineers. An interface between host devices and FPGAs to enable designing and programming FPGAs using a software programming standard and encapsulating hardware details is much desired. In this paper, we evaluate leveraging Open Computing Language (OpenCL) to rapidly design FPGAs, considering both hardware logic utilization efficiency and computing performance. On a heterogeneous computer system consisting of ARM processors and Altera FPGA, we execute an OpenCL host program on the ARM processors and an OpenCL kernel on the FPGA, to compute a parametrizable two-dimensional Mandelbrot fractal. We explore three design aspects of adjusting OpenCL work-group size, coalescing memory access, and replicating compute units to improve the FPGA computation performance. After optimizing the core algorithm, we efficiently reduced the logic utilization and Digital Signal Processing (DSP) blocks required for a single compute unit, and successfully increased the number of replicated compute units from four to six, thus delivering a 1.5X increase of parallel computation capacity of the FPGA, and improving the computing speed by 1.5X and memory bandwidth by 1.7X.
Low-Complexity Subband Digital Predistortion for Spurious Emission Suppression in Noncontiguous Spectrum Access

Noncontiguous transmission schemes combined with high power-efficiency requirements pose big challenges for radio transmitter and power amplifier (PA) design and implementation. Due to the nonlinear nature of the PA, severe unwanted emissions can occur, which can potentially interfere with neighboring channel signals or even desensitize the own receiver in frequency division duplexing transceivers. In this paper, to suppress such unwanted emissions, a low-complexity subband digital predistortion solution, specifically tailored for spectrally noncontiguous transmission schemes in low-cost devices, is proposed. The proposed technique aims at mitigating only the selected spurious intermodulation distortion components at the PA output, hence allowing for substantially reduced processing complexity compared with classical linearization solutions. Furthermore, novel decorrelation-based parameter learning solutions are also proposed and formulated, which offer reduced computing complexity in parameter estimation as well as the ability to track time-varying features adaptively. Comprehensive simulation and RF measurement results are provided, using a commercial LTE-Advanced mobile PA, to evaluate and validate the effectiveness of the proposed solution in real-world scenarios. The obtained results demonstrate that highly efficient spurious component suppression can be obtained using the proposed solutions.

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**Integrating Printed and Silicon Electronics**

The Internet of Everything (IoE) is a vision for the connectivity of anything, at anytime and from anyplace. It will extend today's internet to the physical world that surrounds us (things and objects). To reach the vision of IoE, technical innovation is required in a number of fields from hardware solutions to data management. Stick-it-on devices (SioDs) are one of the revolutionary innovations enabling the vision and bringing intelligence into today's real world objects. SioDs are flexible, energy autonomous, interactive devices that can perform functions like sensing, actuating, computing, and/or communicating.

To incorporate low-power high-performance computing into the SioDs, it is necessary to integrate both flexible printed and silicon components. This presentation focuses on the integration of printed and conventional electronics. It will present progress in 1) SMD mounting, 2) flip-chip bonding, and 3) direct chip connections (e.g. replacement of wire-bonding).

**Combating Unilateral Facial Paralysis With Low-Latency Muscle Reanimation**

**The Challenge:**
Addressing unilateral facial paralysis by creating a measurement and control system for facial pacing, which measures facial movements from the healthy side of the face and uses functional electrical stimulation to simultaneously reanimate the paralysed side.

**The Solution:**
Using myRIO combined with custom electronics to measure multiple channels of surface EMG, process the acquired signals, and produce stimulation waveforms to activate facial muscles with the low-latency and reliability required for this novel medical system.

**Accelerating Computation on an Android Phone with OpenCL Parallelism and Optimizing Workload Distribution between a Phone and a Cloud Service**

We evaluate workload distribution optimization between an Android phone, a cloud service by considering the overall impact of both computation, data transfer. We use OpenCL parallelism on Android to obtain high computation performance. We implement an escape time algorithm to compute the Mandelbrot set with OpenCL, with Java as a reference for comparison. In an experiment of setting the escape boundary at 256, OpenCL offers about 5.0X to 7.5X faster computation compared to Java. With a cloud service, data transfer becomes a dominant factor when the amount of computation is low. In a set of four experiments of sharing workload of computing the Mandelbrot set between a cloud service, a phone, data transfer consumes on average over 80% of processing time. In those experiments computing locally with OpenCL on an Android phone yields faster processing time. On the other hand, local computation capacity becomes a bottleneck when the amount of computation is high. With the escape boundary at 65536, requesting computation from a cloud service yields up to 7.55X speedup.
Titanium Nitride Microelectrodes Deposited by Ion Beam Assisted E-beam Evaporation

An alternative method for fabricating titanium nitride (TiN) microelectrodes is presented. In order to decrease the impedance and noise levels of microelectrodes, one of the most common methods is to coat the electrodes with TiN. Usually that has required the use of a sputtering device, but we have demonstrated that also an e-beam coater can be used for TiN deposition, if equipped with an ion source. Our first 30 µm microelectrodes fabricated by ion beam assisted deposition (IBAD) have impedances around 75 kΩ, which is close to the impedances reported for sputter deposited TiN microelectrodes.

General information
State: Published
Organisations: Department of Automation Science and Engineering, Research area: Microsystems, Research area: Measurement Technology and Process Control, University of Tampere, NeuroGroup, BioMediTech
Authors: Ryynänen, T., Toivanen, M., Narkilahti, S., Lekkala, J.
Publication date: 24 Jun 2016
Peer-reviewed: Unknown
Keywords: microelectrode, Titanium nitride, e-Beam evaporation, Ion beam assisted deposition, MEA
DOIs:
doi: 10.3389/conf.fnins.2016.93.00123
Research output: Scientific › Paper, poster or abstract

Reliability of Passive UHF RFID Copper Tags on Plywood Substrate in High Humidity Conditions

The growth of the wireless world, especially the increasing popularity of the Internet of Things, has created a need for cost-effective and environmentally friendly electronics. Great potential lies especially in versatile applications of passive UHF RFID components. However, the reliability of these components is a major issue to be addressed. This paper presents a preliminary reliability study of glue-coated and non-coated brush-painted copper tags on a plywood substrate in high humidity conditions. The passive UHF RFID components presented in this paper are fabricated using brush-painting and photonic sintering of cost-effective copper oxide ink directly on a plywood substrate. The performance of the glue-coated and non-coated tags is evaluated through wireless tag measurements before and after high humidity testing. The measurement results show that the copper tags on plywood substrate initially achieve peak read ranges of 7-8 meters and the applied coating does not affect to the read range. Moisture does not prevent the coated tags from working in a tolerable way, although the tag performance slightly temporarily decreases due to the moisture absorption. However, when the moisture exposure is long, the performance degradation comes irreversible. The absorbed moisture decreases the read range of the non-coated tags and the performance does not return back to normal after drying. Hence, the coating improves the reliability of the tags in a moist environment compared to the non-coated tags. Based on our results, the plywood material and the used manufacturing methods are very potential for low-cost, high-volume green electronics manufacturing.

General information
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Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Research group: Wireless Identification and Sensing Systems Research Group
Authors: Sipilä, E., Virkki, J., Sydänheimo, L., Ukkonen, L.
Number of pages: 5
Pages: 12-16
Multilevel outphasing power amplifier system with a transmission-line power combiner

This paper presents a multilevel outphasing power amplifier (PA) system consisting of eight class-D unit PAs on 28 nm CMOS and an off-chip transmission-line power combiner. The combiner, implemented on PCB with microstrip lines, was designed to operate at 1.8 GHz frequency and filter out the third and fifth harmonics generated by the PAs. The combiner layout was designed so that the line spacing increases towards the output to reduce coupling, while the lines are equal in length. The simulated maximum output power is 32.3 dBm (1.71 W) with an efficiency of 34.4%. With 20 MHz and 100 MHz LTE signals, average efficiencies of 15.2% and 15.1% were achieved, respectively.

Analysis and Augmented Spatial Processing for Uplink OFDMA MU-MIMO Receiver With Transceiver I/Q Imbalance and External Interference

This paper addresses receiver (RX) signal processing in multiuser multiple-input multiple-output (MU-MIMO) systems. We focus on uplink orthogonal frequency-division multiple access (OFDMA)-based MU-MIMO communications under in-phase/quadrature (I/Q) imbalance in the associated radio frequency electronics. It is shown in the existing literature that transceiver I/Q imbalances cause cross-talk of mirror-subcarriers in OFDM systems. As opposed to typically reported single-user studies, we extend the studies to OFDMA-based MU-MIMO communications, with simultaneous user multiplexing in both frequency and spatial domains, and incorporate also external interference from multiple sources at RX input, for modeling challenging conditions in increasingly popular heterogeneous networks. In the signal processing developments, we exploit the augmented subcarrier processing, which processes each subcarrier jointly with its counterpart at the image subcarrier, and jointly across all RX antennas. Furthermore, we derive an optimal augmented linear RX in terms of minimizing the mean-squared error. The novel approach integrates the I/Q imbalance mitigation, external interference suppression, and data stream separation of multiple UEs into a single processing stage, thus avoiding separate transceiver calibration. Extensive analysis and numerical results show the signal-to-interference-plus-noise ratio (SINR) and symbol-error rate (SER) behavior of an arbitrary data stream after RX spatial processing as a function of different system and impairment parameters. Based on the results, the performance of the conventional per-subcarrier processing is heavily limited under transceiver I/Q imbalances, and is particularly sensitive to external interferers, whereas the proposed augmented subcarrier processing provides a high-performance signal processing solution being able to detect the signals of different users as well as suppress the external interference efficiently. Finally, we also extend the studies to massive MIMO framework, with very large antenna systems. It is shown that, despite the huge number of RX antennas, the conventional linear processing methods still suffer heavily from I/Q imbalances while the augmented approach does not have such limitations.
Comparative study of inkjet and thermal printing for fabrication of passive UHF RFID tags

The need for novel substrate materials and optimized additive manufacturing methods is growing fast as new applications are developed constantly, especially along the emerging paradigm of the Internet of Things. This paper presents a comparison of thermal and inkjet printing for the fabrication of passive UHF RFID tag antennas on commonly used polyimide (Kapton) and on novel polyester-based substrate (Flexcon THERMLfilm) materials. The optimized printing parameters are studied for both substrates using thermal-printed aluminum and inkjet-printed silver materials. Two different tag antenna designs are printed using both methods and their performance is evaluated through wireless tag measurements. According to the measurement results, both printing methods can be used to effectively fabricate passive UHF RFID tag antennas. In addition, the ease of fabrication, the flexibility of printing parameters, and the compatibility with different substrate materials of the two printing methods are studied and discussed in this paper.
Reliability study of flexible inkjet- and thermal-printed RFID antennas in high humidity conditions

The growth of the Internet of Things has created a need for cost-effective and light-weight electronics on flexible substrates. Great potential lies in versatile applications of passive UHF RFID components but their robustness toward various environmental stresses must be ensured. This paper presents a comparison of thermal- and inkjet-printed passive UHF RFID tag antennas on a novel polyester-based substrate (Flexcon THERMLfilm) in high humidity conditions. The tag ICs are coated with two different protective glue materials and the tag performance is evaluated through wireless measurements before and after high humidity testing. According to the results, the coating materials or moisture do not prevent the inkjet-printed tags from working in a tolerable way. The absorbed moisture temporarily shifts the peak read range of the thermal-printed tags to a much lower frequency but the most important reliability challenge is to find a coating material that is compatible with the thermal-printed antennas.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Research group: Wireless Identification and Sensing Systems Research Group
Authors: Rizwan, M., Adhur Kutty, A., Kgwadi, M., Drysdale, T. D., Ukkonen, L., Virkki, J.
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DOIs: 10.1109/EuCAP.2016.7481957
Links: http://ieeexplore.ieee.org/xpl/articleDetails.jsp?arnumber=7481957&refinements%3D3D4221925778%26filter%3DAND%28p_IS_Number%3A7481957%29
Research output: Scientific - peer-review › Conference contribution

Additive Manufacturing of Antennas from Copper Oxide Nanoparticle Ink: Toward Low-Cost RFID Tags on Paper- and Textile-based Platforms

We outline the possibilities of 3D direct write dispensing and brush-painting in the manufacturing of copper UHF RFID tags on textile and cardboard materials and present considerations regarding the process parameters to achieve high-performance tags when the copper antenna is deposited directly on these rough and porous materials. Our measurement results confirm that the additively-manufactured copper RFID tags on environmental-friendly substrates achieve high performance with the attainable theoretical read ranges of 3.5-to-8.5 meters in air.

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Organisations: Department of Electronics and Communications Engineering, Research group: Wireless Identification and Sensing Systems Research Group, Guangdong University of Technology
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Host publication information
Title of host publication: 2016 10th European Conference on Antennas and Propagation (EuCAP)
Publisher: IEEE
ISBN (Print): 978-88-907018-6-3
DOIs: 10.1109/EuCAP.2016.7481676
Research output: Scientific - peer-review › Conference contribution

Introduction to Organic and Printed Electronics

Introduction to the key topics in the field of organic and printed electronics

General information
State: Published
Ministry of Education publication type: B2 Part of a book or another research book
Organisations: Department of Electronics and Communications Engineering, Research group: Laboratory for Future Electronics
Solution-processable graphene and carbon nanotube-based electrode materials were used here to provide electrodes on flexible piezoelectric polyvinylidene fluoride sensors. Piezoelectric sensitivity measurements, image-based analysis, adhesion tests, and sheet resistance measurements were applied to these printable sensors to rigorously analyze their performance and structure. The printable sensors showed electrical performance similar to metallized sensors, whereas the adhesion of the solution-processed materials to the substrate is not as high as that of the evaporated metal films. This also affects the measured sensor sensitivity values. The measurements based on optical images were found to be a promising method to capture detailed information about the electrode surface structure.
Data-Parallel Implementation of Reconfigurable Digital Predistortion on a Mobile GPU

3GPP LTE-A offers new technologies such as non-contiguous carrier allocation for improving radio spectrum utilization. However, implementation of these technologies is challenging because of intermodulation distortion caused by non-linearity of components. Digital Predistortion (DPD) offers a way for compensating for these nonlinearities by modifying the digital baseband signal. As most consumer-oriented mobile devices are equipped with powerful Graphics Processing Units (GPUs), it has become possible to implement DPD functionality to such devices with no additional hardware cost. In this paper, we propose data-parallel, reconfigurable predistortion and measure its performance on mobile GPUs: Qualcomm Adreno 330 and ARM Mali T628.

Sub-band Digital Predistortion for Noncontiguous Transmissions: Algorithm Development and Real-Time Prototype Implementation

This article proposes a novel, reduced complexity, block-adaptive digital predistortion (DPD) technique for mitigating the spurious emissions that occur when amplifying spectrally noncontiguous signals with a nonlinear power amplifier (PA). The introduced DPD solution is designed for real-time scenarios where a loop delay exists in the DPD system. By a proper choice of the DPD parameters, the technique is shown to be robust against arbitrarily long loop delays while not sacrificing DPD linearization performance and convergence speed. Moreover, the proposed DPD solution has lower complexity compared to previously proposed solutions in the literature while giving excellent linearization performance in terms of mitigating the spurious emissions. Real-time implementations of the algorithm on the WARP platform are developed, including considerations for several key trade-offs in the hardware design to balance the robustness, performance and complexity. The simulations and real-time FPGA experiments evidence excellent and robust performance in real-life situations with highly nonlinear PAs and arbitrary loop delays.
Brush-painting and photonical sintering of copper and silver inks on cotton fabric to form antennas for wearable ultra-high-frequency radio-frequency identification tags

Additive deposition of inks with metallic inclusions provides compelling means to embed electronics into clothing in a seamless way. We present a simple single-step brush-painting method for depositing copper and silver inks directly on ordinary cotton fabric and discuss the optimization of the photonical sintering of both materials. For the first time, we demonstrate the deposition and sintering of copper oxide ink on fabric achieving high electrical conductivity suitable for radio-frequency electronics. The results from wireless testing confirmed that the radio-frequency identification tags based on the copper and silver ink antennas were readable from 6 and 10 m, respectively.

Fabrication and characterization of graphene antenna for low-cost and environmentally friendly RFID tags

We present the fabrication and testing of graphene-based dipole antennas on cardboard which is a promising low-cost, recyclable, and flexible substrate for future wireless electronics. The article presents the details of the manufacturing, as well as results from the measurements and simulations. The measured sheet resistance of graphene antenna is 1.9 Ω/sq.
Overall, a graphene-based planar dipole antenna with the length of 143 mm achieved the measured total efficiency of 40% and the realized gain of ∼2.18 dBi at 889 MHz. Moreover, a passive ultra-high-frequency radio-frequency tag based on a graphene dipole antenna on cardboard achieved the attainable read range of more than five meters at 950 MHz.

**General information**

State: Published

Ministry of Education publication type: A1 Journal article-refereed

Organisations: Department of Electronics and Communications Engineering, Research group: Wireless Identification and Sensing Systems Research Group

Authors: Akbari, M., Khan, M., Hasani, M., Björninen, T., Sydänheimo, L., Ukkonen, L.

Pages: 1569-1572

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Peer-reviewed: Yes

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Journal: IEEE Antennas and Wireless Propagation Letters

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ISSN (Print): 1536-1225

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Scopus rating (2015): SJR 1.572 SNIP 1.925 CiteScore 2.9

Scopus rating (2014): SJR 1.517 SNIP 1.927 CiteScore 2.79

Scopus rating (2013): SJR 1.202 SNIP 1.703 CiteScore 2.82

Scopus rating (2012): SJR 1.005 SNIP 1.517 CiteScore 2.71

Scopus rating (2011): SJR 0.926 SNIP 1.54 CiteScore 2.32

Scopus rating (2010): SJR 0.736 SNIP 1.25

Scopus rating (2009): SJR 1.083 SNIP 1.582

Scopus rating (2008): SJR 0.794 SNIP 1.256

Scopus rating (2007): SJR 1.421 SNIP 2.221

Scopus rating (2006): SJR 1.599 SNIP 1.911

Scopus rating (2005): SJR 1.943 SNIP 1.839

Scopus rating (2004): SJR 1.411 SNIP 1.972

Scopus rating (2003): SJR 0.918 SNIP 1.391

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Research output: Scientific - peer-review › Article

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**General information**

State: Published

Ministry of Education publication type: A1 Journal article-refereed

Organisations: Department of Electronics and Communications Engineering, Research group: System-on-Chip for GNSS, Wireless Communications and Cyber-Physical Embedded Computing, University of Chicago

Authors: Hussain, W., Airoldi, R., Hoffmann, H., Ahonen, T., Nurmi, J.

Pages: 341-353

Publication date: 2016

Peer-reviewed: Yes

Early online date: 1 Jan 2015

**Publication information**

Journal: Journal of Signal Processing Systems

Article number: 10.1007/s11265-015-1054-9

ISSN (Print): 1939-8018
Heat capacities of crystalline and glassy lithium metaphosphate up to the transition region

Heat capacity measurements have been conducted by means of DSC on both crystalline and glassy lithium metaphosphate, from room temperature up to the melting region. The heat capacity of the glass is slightly higher than that of the crystal. Contrary to the crystal, in the neighborhood of $T_g$, $C_p$ increases rapidly by 10 J mol$^{-1}$ K$^{-1}$ conferring to this glass a "fragile character." Nevertheless, the passage through $T_m$ does not show any discontinuity and the values of the glass and of the crystal are identical. The Debye model appears to be realistic to describe the glass heat capacity to temperature dependence. The Debye temperature and frequency were determined by minimizing the $R_p$ and $\chi^2$ parameters of the $C_v$ fitting curve. From the calculation of the entropy of the liquid at $T > T_m$, the excess entropy of the glass at $T_g$ was determined. Using the dependence of the glass transition on the heating rate, we calculated the values of the activation energy for structural relaxation ($E_{\text{relax}}$) and of the lower limit of the glass transition temperature ($T_{g^\circ}$) which is a thermodynamic parameter, contrary to $T_g$ which is a kinetic parameter.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Research group: Biomaterials and Tissue Engineering Group, Glass and Ceramic Group, ISCR 6226, University of Rennes, 35700 Rennes, France, University of Rennes 1 - IETR, UMR CNRS 6226 Sciences Chimiques de Rennes
Authors: Rocherullé, J., Massera, J., Oudadesse, H., Calvez, L., Trolès, J., Zhang, X. H.
Number of pages: 7
Pages: 401-407
Publication date: 2016
Peer-reviewed: Yes
Joint 3D Positioning and Network Synchronization in 5G Ultra-Dense Networks Using UKF and EKF

It is commonly expected that future fifth generation (5G) networks will be deployed with a high spatial density of access nodes (ANs) in order to meet the envisioned capacity requirements of the upcoming wireless networks. Densification is beneficial not only for communications but it also creates a convenient infrastructure for highly accurate user node (UN) positioning. Despite the fact that positioning will play an important role in future networks, thus enabling a huge amount of location-based applications and services, this great opportunity has not been widely explored in the existing literature. Therefore, this paper proposes an unscented Kalman filter (UKF)-based method for estimating directions of arrival (DoAs) and times of arrival (ToA) at ANs as well as performing joint 3D positioning and network synchronization in a network-centric manner. In addition to the proposed UKF-based solution, a similar extended Kalman filter (EKF)-based method is proposed by extending the existing 2D EKF-based approach to cover also realistic 3D scenarios. Building on the premises of 5G ultradense networks (UDNs), the performance of both methods is evaluated and analysed in terms of DoA and ToA estimation as well as positioning and clock offset estimation accuracy, using the METIS map-based ray-tracing channel model and 3D trajectories for vehicles and unmanned aerial vehicles (UAVs) through the Madrid grid. Based on the comprehensive numerical evaluations, both proposed methods can provide the envisioned one meter 3D positioning accuracy even in the case of unsynchronized 5G network while simultaneously tracking the clock offsets of network elements with a nanosecond-scale accuracy.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Research group: Wireless Communications and Positioning
Authors: Koivisto, M., Costa, M. J., Hakkarainen, A., Leppänen, K., Valkama, M.
Number of pages: 7
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Research output: Scientific - peer-review › Conference contribution

Optimization of parallel processing intensive digital front-end for IEEE 802.11ac receiver
Modern computing platforms offer increasing levels of parallelism for the fast execution of different signal processing tasks. In this paper a digital front-end concept is developed, where the parallel processing is utilized for dividing the inherent structure of IEEE 802.11ac waveform to two or more parallel signals and by processing the resulting signals
further e.g., using legacy IEEE 802.11n
digital receiver chains. Two multirate channelization architectures are developed with the corresponding filter coefficient
optimization. The full radio link performance simulations with commonly adopted indoor WiFi channel profiles are provided,
verifying the overall link performance with the proposed channelization architectures.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Research group: Wireless Communications
and Positioning
Authors: Yli-Kaakinen, J., Levanen, T., Aghababaeetafreshi, M., Renfors, M., Valkama, M.
Number of pages: 5
Publication date: 2016

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Research output: Scientific - peer-review › Conference contribution

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Organisations: Department of Electronics and Communications Engineering, Research group: Laboratory for Future
Electronics
Authors: Mäntysalo, M., Vuorinen, T., Suikkola, J.
Publication date: 2016
Peer-reviewed: Unknown
Research output: Scientific › Paper, poster or abstract

Remotely Powered Piezoresistive Pressure Sensor: Toward Wireless Monitoring of Intracranial Pressure
This paper presents the results of pressure measurements taken after the successful activation of an implantable
piezoresistive pressure sensor. The sensor was activated using inductive power transmission for an Intracranial Pressure
(ICP) monitoring application. This generated sufficient power (4.47 mW) and voltage (1.894 V) at the sensor input to
monitor the pressure changes. Although the changes in voltage were monitored through wires, the required electronics for
wireless voltage transfer and measurement in a biological environment are planned in the future. The simulated and
measured results of the wireless link, along with the measured changes in pressure are presented. The results are the first
step towards a wirelessly powered implant for ICP monitoring.

General information
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Sensing Systems Research Group
Authors: Khan, M. W. A., Björninen, T., Sydänheimo, L., Ukkonen, L.
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Scopus rating (2015): SJR 0.804 SNIP 1.541 CiteScore 2.32
Scopus rating (2014): SJR 1.199 SNIP 1.974 CiteScore 2.56
Scopus rating (2013): SJR 1.603 SNIP 2.191 CiteScore 3.09
Tools for Visualizing Cuts in Electrical Engineering Education

We study the visualization of electromagnetic (EM) phenomena from an educational perspective. We exploit software and 3-D printing for visualization, and demonstrate their use in enhancing student learning. Our focus is on so-called cuts, which highlight important topological information in EM problems. However, the discussion aims to benefit electrical engineering education in general. This paper emphasizes some higher level learning goals in an undergraduate engineering education that can be realized with existing free tools. The process goes beyond what computer-aided design (CAD) packages will typically teach, and serves as a hands-on learning exercise in software programming and finite-element techniques.

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Organisations: Department of Electronics and Communications Engineering
Authors: Stockrahm, A., Kangas, J., Kotiuga, P. R.
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Peer-reviewed: Yes
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ISSN (Print): 0018-9464
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Scopus rating (2015): SJR 0.565 SNIP 1.207 CiteScore 1.77
Scopus rating (2014): SJR 0.715 SNIP 1.491 CiteScore 1.68
Scopus rating (2013): SJR 0.608 SNIP 1.424 CiteScore 1.75
Scopus rating (2012): SJR 0.788 SNIP 1.574 CiteScore 1.89
Scopus rating (2011): SJR 0.829 SNIP 1.445 CiteScore 1.69
Scopus rating (2010): SJR 0.698 SNIP 1.134
Scopus rating (2009): SJR 0.644 SNIP 1.098
Scopus rating (2008): SJR 0.788 SNIP 1.165
Scopus rating (2007): SJR 0.71 SNIP 1.152
Scopus rating (2006): SJR 0.913 SNIP 1.232
Scopus rating (2005): SJR 1.024 SNIP 1.258
Scopus rating (2004): SJR 0.813 SNIP 1.129
Self-Aligned Patterning Methods for Large-Area Electronics

Printed electronics is studied as an alternative to conventional electrics, especially for large-area applications, such as organic light emitting diode (OLED) lighting panels. The whole technology, however, suffers from a low resolution and registration accuracy in the printing process, limitations that directly affect the performance of the applications. Photolithography can overcome these limitations and provide both good registration accuracy and resolution, but it is a challenging process in high throughput fabrication. Thus new fabrication methods are being studied intensively to replace expensive lithography steps in the fabrication chain.

This thesis presents two alternative fabrication methods with a scale-up capacity for high volume production. The first combines fast low-resolution patterning with roll-to-roll scalable high resolution microcutting; the second was developed to accurately align dielectric patterns on conductors. The latter uses an electric current to heat metal lines and cure a polymer dielectric locally near the conductor. Uncured polymer is rinsed away, leaving an aligned dielectric on the lines. The method is well suited for passivating OLED anode grid lines, which require excellent registration accuracy to prevent significant losses in the device active area.

The layer-to-layer registration accuracy of Joule heating is defined by heat conduction in the substrate. Thus the accuracy can be increased either by selecting a thermally low conductive substrate or by using short current pulses. The latter method allows more freedom to design the other process parameters and materials. An optimal pulse length depends on the substrate material in that materials with high thermal conductivity require short heating pulses. Here though the pulse lengths are of the order of milliseconds, which are easy to produce. In addition to increased registration accuracy, pulsed heating significantly cuts down the processing time and required energy.

In this thesis, a dielectric registration accuracy of 2 µm was demonstrated on shadow-mask-evaporated silver lines on glass, a value similar to that reported for registration accuracy in roll-to-roll photolithography, 1 µm. Joule heating, however, does not require challenging alignment steps. To demonstrate the feasibility of Joule heating for passivation in an OLED device, a printed silver current distribution grid was passivated using pulsed Joule heating and fabricated as an OLED device.

The Joule heating work constituted not only an experimental study but involved extensive finite element simulations to obtain design rules for the current distribution grid and to study the heating selectivity. The idea of the pulsed heating was also a result of this work.

General information
State: Published
Ministry of Education publication type: G5 Doctoral dissertation (article)
Organisations: Research group: Laboratory for Future Electronics, Department of Electronics and Communications Engineering
Authors: Janka, M.
Number of pages: 43
Publication date: 11 Dec 2015

Publication information
Publisher: Tampere University of Technology
Original language: English

Publication series
Name: Tampere University of Technology, Publication
Publisher: Tampere University of Technology
Volume: 1341
ISSN (Print): 1459-2045
Electronic versions:
janka_1341
Characterization of Two-TURNS External Loop Antenna with Magnetic Core for Efficient Wireless Powering of Cortical Implants

Performance Evaluation of Circularly Polarized Patch Antenna on Flexible EPDM Substrate Near Human Body

This paper presents the performance evaluation of a circularly polarized wearable antenna on flexible Ethylene Propylene Diene Monomer (EPDM) foam substrate. EPDM is a rubber based material with high flexibility, good shock resistance and easy attachment to any curved surface. The designed antenna operates for Industrial, Scientific and Medical (ISM) band and Wireless Body Area Network (WBAN) applications at 2.45 GHz. Copper tape is used as the conductive material for the patch and the ground plane on 3 mm thick EPDM foam substrate having dielectric constant 1.23 and loss tangent 0.02. A rectangular slot along diagonal axis at the center of the circular patch is used for achieving circular polarization at 2.45 GHz. The measured operating frequency range of the antenna spans from 2.36 GHz to 2.48 GHz with the gain of 6.03 dB at 2.45 GHz. A set of comparative results of the antenna in free space and different body parts like arm and leg are compared to validate the operability of the antenna in real environment. This study provides new understanding about rubber material as substrate for flexible wearable antennas.
A survey of printable piezoelectric sensors

Availability of solution-processable piezoelectric sensor and electrode materials enable low-cost and high-throughput fabrication of fully printable piezoelectric sensors. Results obtained with piezoelectric polymer (polyvinylidenefluoride, PVDF), cellulose nanofibril (CNF) and cellulose nanocrystal (CNC) films as sensor materials are presented here. These sensor materials can be processed in solution and used in combination with printed electrodes to obtain full printability of the sensors. A commercial PVDF film and in-house fabricated CNF and CNC film are used as sensor materials. In addition, conducting polymer, graphene and carbon nanotube (CNT) based inks are used as solution-processable electrode materials in the sensors, whereas conventional metallic electrodes are used as reference electrode material. The sensor operation of the fabricated sensors is evaluated through piezoelectric sensitivity measurements. The sensor sensitivity measurements revealed mean sensitivities from 2 pC/N to 42 pC/N in transverse direction, depending on set of the sensor and electrode materials used.

High speed DC-DC dead time architecture

A novel and simple solution for adjusting dead time in high speed DC-DC converters is proposed. The usual dead time adjustment of DC-DC converters through feedback control has limited speed. For the high speed converters extra circuitry and delays in the feedback should be minimized. A 240 MHz DC-DC converter with the presented dead time circuit is designed on low-voltage fast CMOS process.
ESD qualification data used as the basis for building electrostatic discharge protected areas

ESD control programs that are based on the standards IEC61340-5-1 and ANSI/ESD S20.20 are targeted to provide safer handling of electronic parts now susceptible to damage by electrostatic discharge. However, ESD failures have occurred in EPA even when all standard control methods are met. To further improve EPAs, ESD control programs should be updated to cover all known common discharge scenarios, and multiple parallel ESD source parameters should be used to assess the level of ESD risks. In addition, a reliable ESD risk assessment should be based on discharge source circuit analysis and product sensitivity tests using the real discharge waveforms found in EPA.
Benchmarking of Factory Level ESD Control

A standard compliance of the factory level ESD control varies between organizations. We have audited twelve different factories during the 24-month benchmarking period. These audits were focused on the ESD control programs and the process control. The summary of results and examples of the best practices are presented in this paper.

ESD and Disturbance Cases in Electrostatic Protected Areas

Electrostatic protected area (EPA) can effectively prevent ESD failures from charged operators, work benches and tools. However, electrical disturbances and ESD events from other sources can still exist in well-built EPAs. In this paper failures found in electronic assembly environments are analyzed to improve coverage of ESD control programs.
The effect of USB ground cable and product dynamic capacitance on IEC61000-4-2 qualification

IEC61000-4-2 discharge stress levels are studied with varying product capacitance and ground connections. Stress levels are evaluated based on the measured and simulated peak current, peak power, pulse rise time, and energy transfer along to the USB cable. These stress parameters can be significantly affected by adjusting the test setup.

Uncertainties in Charge Measurements of ESD Risk Assessment

Charge measurement techniques are often considered too complicate to the process control of electronics manufacturing. In his study, we show that expensive instrumentation is not necessarily needed for characterizing ESD source parameters in a risk assessment. Measurement can be made accurately when uncertainties are properly taken into account.
Circularly Polarized Textile Antenna For 2.45 GHz

This paper presents a circularly polarized antenna on thin and flexible Denim substrate for Industrial, Scientific and Medical (ISM) band and Wireless Body Area Network (WBAN) applications at 2.45 GHz. Copper tape is used as the conductive material on 1 mm thick Denim substrate. Circular polarization is achieved by introducing rectangular slot along diagonal axes at the center of the circular patch radiator. Bandwidth enhancement is done using partial and slotted ground plane. The measured impedance bandwidth of the proposed antenna is 6.4 % (2.42 GHz to 2.58 GHz) or 160 MHz. The antenna exhibits good radiation characteristics with gain of 2.25 dB. Simulated and measured results are presented to validate the operability of antenna within the proposed frequency bands.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Research group: Wireless Identification and Sensing Systems Research Group, Sensing Systems for Wireless Medicine (MediSense), Department of Electrical Engineering, University of California, Los Angeles, California, USA
Authors: Rizwan, M., Rahmat-Samii, Y., Ukkonen, L.
Number of pages: 2
Pages: 51-52
Publication date: 21 Sep 2015

Host publication information
Title of host publication: Circularly Polarized Textile Antenna For 2.45 GHz
Publisher: IEEE
Keywords: Denim, Industrial, Scientific and Medical (ISM) band, Wireless Body Area Network (WBAN), Textile antenna, Circular Polarization
DOIs:
10.1109/IMWS-BIO.2015.7303755
Research output: Scientific - peer-review › Conference contribution

The Assessment and Reduction of Motion Artifact in Dry Contact Biopotential Electrodes

The connecting interface between biopotential monitoring systems and the human body is the electrode. Conventional medical electrodes use gel to improve skin-electrode contact and glue to provide secure attachment of the electrode to the skin. However, this type of electrode is neither reusable nor user-friendly when implemented in wearable monitoring systems. For wearable monitoring systems, the best type of electrode to use, as seen from the point of view of user comfort and ease of use of the wearable system, is the un-gelled electrode. The un-gelled electrode foregoes conductive gel and attachment glue and instead uses body moisture and clothing pressure to provide contact and secure attachment. The drawback of un-gelled electrodes is that they are susceptible to the wearer's movements, namely, to motion artifact.

Solving the issue of motion artifact will improve signal quality and reliability for wearable systems and, due to integration and reusability, would reduce costs. These two factors, when combined, would enable the widespread use of wearable monitoring systems in both the medical context and the consumer-user context. One effect of this will be a reduction in load and costs on health care systems due to improved preventive monitoring and better monitoring of patients in the recovery and rehabilitation phase. A second effect, combined with the information exchanging channels between individuals, will be unforeseen developments in health science due to what can be called the crowdsourcing of some aspect of physical and mental health and fitness.

This thesis aims to further state-of-the-art wearable physiological monitoring by aiding motion artifact research and electrode design. To accomplish this aim, investigations into the programmable and repeatable generation of electrode movement in order to generate motion artifact, the effect of impedance current frequency on the relationship between skin-
electrode interface impedance and electrode movement and motion artifact, the effect of using an electrode support structure and how its design affects the motion artifact, and the effects of garment parameters such as tightness are presented in this thesis.

A system that generates known and programmable motion of the electrode under controlled circumstances was designed, tested, and after the verification of system functionality, used in subsequent investigations. The presented system generates accurate motion of the electrode and the electrode motion can be observed as both motion artifact and skin-electrode impedance changes.

A real time impedance spectroscopy study of 24 impedance current frequencies between 25 Hz and 1 MHz was done on electrodes subject to accurately known motion generated by the designed system in order to find the impedance current frequencies most suited to motion artifact studies.

During this research, a hypothesis was formed that states that an electrode with a structural design that restricts epidermis deformation by trapping the epidermis under the electrode area can reduce motion artifact. Different electrode support structures were designed in order to test this hypothesis. The electrodes with support structures were subjected to system-generated motion and the resulting data were analyzed for the verification of support structure functionality and the hypothesis.

Electrodes that were supported by a tight garment-mimicking elastic straps were studied under subject-generated movement and at various clothing tightness levels. The same study was used to understand the effect of using padding between the garment and the electrode.

The motion artifact generation system was seen to be successful in accurately generating electrode motion, thus motion artifact, which was programmable and repeatable. The electrode mounting force monitoring proved to be an important functionality as the mounting force was seen to affect the motion artifact.

Skin-electrode impedance was found to correlate well with electrode motion in current frequencies between 17 kHz and 1 MHz. While the correlation between impedance and motion artifact was lower than the correlation between impedance and electrode motion, it was also highest in this frequency band.

Electrode support structure design is seen to be an important factor to consider when designing the electrode, and the electrodes that came closest to fulfilling the design criteria of the hypothesis were the best functioning electrodes. The hypothesis is seen to be promising and electrodes that distributed skin deformation over a large area and/or restrict epidermis deformation were found to reduce motion artifact.

In the presented studies, the pressures under those electrodes that were found to be the most effective in reducing motion artifact differed between experiments yet stayed in a range between 5 mmHg -36 mmHg (0.66 kPa – 4.80 kPa). A simple guideline is that the electrode should be attached firmly but not so firmly that it becomes uncomfortable. This guideline fitted well with the pressure levels found for each experiment.

The presented Motion Artifact Generation and Assessment System can be used for research or commercial purposes, furthering the research on motion artifact and aiding in the successful design of motion artifact resilient electrodes. The issue of which are the best current frequencies to use to measure skin-electrode interface impedance in motion artifact research has been clarified. Possible means of reducing motion artifact at its origin by using structural electrode designs that restrict epidermis deformation is hypothesized and proven worthy of further research. The importance of garment design and guidelines for use are given and tightness recommendations presented. The thesis presents methodology for the furthering of the understanding of motion artifact and electrode design that will eventually make wearable monitoring systems widespread over a large range of applications and a large number of users.
Passivation of organic light emitting diode anode grid lines by pulsed Joule heating

We report the self-aligned passivation of a current distribution grid for an organic light emitting diode (OLED) anode using a pulsed Joule heating method to align the passivation layer accurately on the metal grid. This method involves passing an electric current through the grid to cure a polymer dielectric. Uncured polymer is then rinsed away, leaving a patterned dielectric layer that conforms to the shape of the grid lines. To enhance the accuracy of the alignment, heat conduction into the substrate and the transparent electrode is limited by using short current pulses instead of a constant current. Excellent alignment accuracy of the dielectric layer on printed metal grid lines has been achieved, with a typical 4-μm dielectric overhang. In addition to good accuracy, pulsed Joule heating significantly cuts down process time and energy consumption compared to heating with a constant current. The feasibility of using a printed current distribution grid and Joule heating was demonstrated in an OLED device.
Effect of magnetic core and higher operational frequency on sensitivity in frequency shift detection in wireless passive minimally invasive intracranial pressure monitoring

General information
State: Published
Authors: Khan, M., Behfar, M., Björninen, T., Ukkonen, L., Sydänheimo, L.
Pages: 383-386
Publication date: Sep 2015

Manufacturing of antennas for passive UHF RFID tags by direct write dispensing of copper and silver inks on textiles
We report for the first time the deposition antennas on textiles using the direct write dispensing of a copper ink. We outline the steps of the dispensing process and share our insight on how to control it on the rough and porous textile surface. The well-known heat sintering is not applicable on copper inks. Below we outline the process of intense pulsed light sintering to form copper based electro-textile. Using the manufactured electro-textile antenna we have assembled a fully functional radio-frequency identification tag. We compare its performance with other tags based on electro-textile antennas manufactured with several other methods and materials.

General information
State: Published
Authors: Björninen, T., Virkki, J., Sydänheimo, L., Ukkonen, L.
Pages: 589-592
Publication date: Sep 2015

Two-turns antenna and magnetic materials for effective powering of mm-size implant in wireless brain-machine interface system

General information
State: Published
Authors: Khan, W., Björninen, T., Ukkonen, L., Sydänheimo, L.
Number of pages: 2
Pages: 103-104
Publication date: Sep 2015
Examples of electromagnetic field (50–100 kHz) emissions from smart meters in Finland

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Research group: Environmental Health, TMI
Rauno Pääkkönen, Tampereen Sähköverkko Oy
Authors: Pääkkönen, R., Lundström, M., Mustaparta, J., Korpinen, L.
Number of pages: 3
Pages: 225 - 227
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Volume: 50
Issue number: 3
ISSN (Print): 0033-8451
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Scopus rating (2015): SJR 0.246 SNIP 0.385 CiteScore 0.33
Scopus rating (2014): SJR 0.226 SNIP 0.33 CiteScore 0.3
Scopus rating (2013): SJR 0.262 SNIP 0.326 CiteScore 0.24
Scopus rating (2012): SJR 0.238 SNIP 0.234 CiteScore 0.13
Scopus rating (2011): SJR 0.258 SNIP 0.597 CiteScore 0.33
Scopus rating (2010): SJR 0.237 SNIP 0.383
Scopus rating (2009): SJR 0.18 SNIP 0.351
Scopus rating (2008): SJR 0.228 SNIP 0.471
Scopus rating (2007): SJR 0.253 SNIP 0.705
Scopus rating (2006): SJR 0.152 SNIP 0.264
Scopus rating (2005): SJR 0.197 SNIP 0.47
Scopus rating (2004): SJR 0.184 SNIP 0.497
Scopus rating (2003): SJR 0.148 SNIP 0.331
Scopus rating (2002): SJR 0.146 SNIP 0.171
Scopus rating (2001): SJR 0.162 SNIP 0.253
Scopus rating (2000): SJR 0.225 SNIP 0.507
Scopus rating (1999): SJR 0.846 SNIP 0.652
Original language: English
ASJC Scopus subject areas: Electrical and Electronic Engineering
DOIs:
10.1051/radiopro/2015004
Research output: Scientific - peer-review › Article

Examples of extremely low-frequency magnetic fields in a Finnish metro station

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Research group: Environmental Health, Research group: Wireless Identification and Sensing Systems Research Group, Sensing Systems for Wireless Medicine (MediSense), Helsinki City Transport, Combinova, Rejlers Oy
Determination of asymmetry of currents and voltages in high voltage power transmission with a long transmission line

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Research group: Environmental Health, Department of Electrical Energy National Technical University, Kharkiv Polytechnic Institute, LLC Soyuzenergoproekt, Kharkiv
Authors: Okun, O., Ivanov, Y., Korpinen, L.
Number of pages: 5
Publication date: 23 Aug 2015

Host publication information
Title of host publication: ISH2015 - The 19th International Symposium on High Voltage Engineering, Pilsen, Czech Republic, August, 23 – 28, 2015
Place of publication: Pilsen, Czech Republic
ASJC Scopus subject areas: Electrical and Electronic Engineering
Links:
Research output: Scientific - peer-review › Conference contribution
Estimation of induced currents in the human body exposed to non-uniform ELF electric fields

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Research group: Environmental Health, National Institute of technology, Anan Collage, University of Miayazaki, National Institute of Technology, Kagawa College, Japan, University of Tokushima
Authors: Tarao, H., Miyamoto, H., Hayashi, N., Matsumoto, T., Korpinen, L., Isaka, K.
Number of pages: 4
Publication date: 23 Aug 2015

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Place of publication: Pilsen, Czech Republic
Article number: 166
ASJC Scopus subject areas: Electrical and Electronic Engineering
Links:
Research output: Scientific - peer-review › Conference contribution

Occupational exposure to magnetic fields while working around a reactor at a 400 kV substation in Finland

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Research group: Environmental Health, TMI Rauno Pääkkönen, University of Modena and Reggio Emilia
Authors: Pääkkönen, R., Korpinen, L., Gobba, F.
Number of pages: 3
Publication date: 23 Aug 2015

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Place of publication: Pilsen, Czech Republic
Article number: 163
ASJC Scopus subject areas: Electrical and Electronic Engineering
Links:
Research output: Scientific - peer-review › Conference contribution

Possibility of decreasing 50 Hz electric field exposure with different coveralls under 400 kV power lines

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Research group: Environmental Health, Department of Electrical and Computer Engineering Kagawa National College of Technology, TMI Rauno Pääkkönen, University of Modena and Reggio Emilia
Authors: Korpinen, L., Tarao, H., Pääkkönen, R., Gobba, F.
Number of pages: 3
Publication date: 23 Aug 2015

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Place of publication: Pilsen, Czech Republic
Article number: 161
**Cascoded Power Stage With Automatic Dead Time Generation**

The paper presents a cascoded power stage with automatic dead time generation. The circuit is using the inter-transistor node voltages of the cascode configuration as feedback control signals to delay turning ON the power transistors. The circuit is designed as the output stage of a fully-integrated buck converter. The steady-state operation is described. The waveforms simulated on 45-nm CMOS process show that in steady-state operation the short-circuit path and body diode conductions are avoided while effective zero-voltage switching (ZVS) are provided both for ground and power supply line; the calculated dead times are in a good agreement with simulation results.

**General information**

State: Published

Ministry of Education publication type: A4 Article in a conference publication

Organisations: Department of Electronics and Communications Engineering, Research group: RF Integrated Circuits, University of Calgary, Alberta, Canada

Authors: Filanovsky, I., Järvenhaara, J., Tchamov, N.

Number of pages: 4

Publication date: 2 Aug 2015

**Host publication information**


Publisher: IEEE

ISBN (Print): 978-1-4673-6557-4

ASJC Scopus subject areas: Engineering(all), Energy(all)

Keywords: DC-DC converters, Buck converter, Cascoded Stage, Dead time auto-generation, ZVS

DOIs: 10.1109/MWSCAS.2015.7282019

**An Asymmetric VHF Self-Oscillating DC-DC Converter with Integrated Transformer**

The paper presents a self-oscillating DC-DC integrated converter which is operable in the frequency range of 200MHz-260MHz. The circuit includes a cascoded power stage, and an integrated transformer. The primary of the transformer provides the transmission of power to the converter load. The secondary provides the feedback signal to the gates of cascoded transistors in the power stage. The feedback circuit includes a duty cycle detector and a pulse-shaping circuit. A detailed analysis of duty cycle detector operation is given. The conditions for a smooth start-up are indicated as well. The circuit was designed and simulated for 45 nm CMOS technology, and the calculated parameters of the duty cycle detector are compared with that of the extracted from layout converter.

**General information**

State: Published

Ministry of Education publication type: A4 Article in a conference publication

Organisations: Department of Electronics and Communications Engineering, Research group: RF Integrated Circuits

Authors: Akbar, R., Filanovsky, I., Järvenhaara, J., Tchamov, N.

Number of pages: 4

Publication date: Aug 2015

**Host publication information**

Title of host publication: 2015 IEEE 58th International Midwest Symposium on Circuits and Systems (MWSCAS)

Publisher: IEEE

ISBN (Print): 978-1-4673-6557-4

Keywords: VHF DC-DC converter, Integrated DC-DC converter, Self-Oscillating converter, Integrated transformer, Duty cycle detector, Smooth start-up

ASJC Scopus subject areas: Electrical and Electronic Engineering

DOIs: 10.1109/MWSCAS.2015.7282018

**Cardiac pacemakers in magnetic fields of a shunt reactor at a 400 kV substation**
Self-reported depression and anxiety symptoms and usage of computers and mobile phones among working-age Finns

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Research group: Environmental Health, Fingrid Oyj, The Heart Center, Tampere University Hospital
Authors: Korpinen, L., Kuisti, H., Tarao, H., Elovaara, J., Virtanen, V.
Number of pages: 4
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Scopus rating (2016): SJR 0.259 SNIP 0.673 CiteScore 0.64
Scopus rating (2015): SJR 0.284 SNIP 0.729 CiteScore 0.65
Scopus rating (2014): SJR 0.23 SNIP 0.62 CiteScore 0.56
Scopus rating (2013): SJR 0.232 SNIP 0.853 CiteScore 0.65
Scopus rating (2012): SJR 0.344 SNIP 0.732 CiteScore 0.77
Scopus rating (2011): SJR 0.286 SNIP 0.578 CiteScore 0.39
Scopus rating (2010): SJR 0.221 SNIP 0.341
Scopus rating (2009): SJR 0.272 SNIP 0.673
Scopus rating (2008): SJR 0.369 SNIP 0.488
Scopus rating (2007): SJR 0.431 SNIP 0.618
Scopus rating (2006): SJR 0.205 SNIP 0.427
Scopus rating (2005): SJR 0.216 SNIP 0.257
Scopus rating (2004): SJR 0.224 SNIP 0.45
Scopus rating (2003): SJR 0.19 SNIP 0.344
Scopus rating (2002): SJR 0.205 SNIP 0.403
Scopus rating (2001): SJR 0.141 SNIP 0.333
Scopus rating (2000): SJR 0.136 SNIP 0.264
Scopus rating (1999): SJR 0.197 SNIP 0.372
Original language: English
ASJC Scopus subject areas: Electrical and Electronic Engineering
DOIs: 10.1080/10803548.2015.1029286
Research output: Scientific › peer-review › Article
Inkjet printed single layer high-density circuitry for a MEMS device

For example high-density redistribution layers (RDL) require narrow conductor width and low enough resistance. We have studied the applicability of an additive electrodynamic inkjet printer, Super Inkjet (SIJ), as a potential replacement for the current non-additive manufacturing method used in circuitry fabrication for MEMS devices. This was done by examining the topography of the printed lines and relating this to the resistance. For example five and two micron wide conductors were demonstrated with aspect ratio as high as 0.8 and 0.9. The average resistivity value for the five micron wide conductors was 17 μOhm·cm and 15 μOhm·cm for the two micron case. Also the repeatability of the line width calibration process was evaluated. The accuracy was found to be approximately one micron.
Examples of Electromagnetic Field Sources in an Indoor Distribution Substation

The paper presents example measurements of electromagnetic fields in an indoor distribution substation. We measured at different places: At Place A (near the fuse panel), using (1) frequency bandwidth (FB) 40kHz-100kHz, fields varied 0.011-0.039 μT and using (2) FB 5Hz-100kHz, fields varied 67-74 μT; at Place B (the surface of the collector meter), the fields varied from 0.022 to 0.083 μT (40kHz-100kHz); at Place C (near the antenna of the collector meter), the maximum radio frequency field was 1.0 W/m2, and at Place D (the surface of the antenna), it was 1.8 W/m2. The measured values were below ICNIRP guidelines.

General Information
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Ministry of Education publication type: A4 Article in a conference publication
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Authors: Pääkkönen, R., Lundström, M., Mustaparta, J., Korpinen, L.
Number of pages: 3
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Publication date: 6 Jul 2015

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Publication series
Name: Progress in electromagnetics research symposium
ISSN (Electronic): 1559-9450
ASJC Scopus subject areas: Electrical and Electronic Engineering
Links:
Research output: Scientific - peer-review » Conference contribution

Examples of Variation in Measured ELF Electric Fields under 400 kV Power Lines

The paper presents example measurements of electromagnetic fields under 400 kV power lines. We measured at different places: At Place A (near the fuse panel), using (1) frequency bandwidth (FB) 40kHz-100kHz, fields varied 0.011-0.039 μT and using (2) FB 5Hz-100kHz, fields varied 67-74 μT; at Place B (the surface of the collector meter), the fields varied from 0.022 to 0.083 μT (40kHz-100kHz); at Place C (near the antenna of the collector meter), the maximum radio frequency field was 1.0 W/m2, and at Place D (the surface of the antenna), it was 1.8 W/m2. The measured values were below ICNIRP guidelines.

General Information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Research group: Environmental Health, Sensing Systems for Wireless Medicine (MediSense), TMI Rauno Pääkkönen, Turku Energia Sähköverkot Oy, Tampereen Sähköverkko Oy
Authors: Pääkkönen, R., Lundström, M., Mustaparta, J., Korpinen, L.
Number of pages: 4
Pages: 561 - 564
Publication date: 6 Jul 2015

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Publisher: Electromagnetics Academy
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Publication series
Name: Progress in electromagnetics research symposium
ISSN (Print): 1559-9450
ASJC Scopus subject areas: Engineering(all), Electrical and Electronic Engineering
Links:
Research output: Scientific - peer-review » Conference contribution

Examples of Variation in Measured ELF Electric Fields under 400 kV Power Lines

The paper presents example measurements of electromagnetic fields under 400 kV power lines. We measured at different places: At Place A (near the fuse panel), using (1) frequency bandwidth (FB) 40kHz-100kHz, fields varied 0.011-0.039 μT and using (2) FB 5Hz-100kHz, fields varied 67-74 μT; at Place B (the surface of the collector meter), the fields varied from 0.022 to 0.083 μT (40kHz-100kHz); at Place C (near the antenna of the collector meter), the maximum radio frequency field was 1.0 W/m2, and at Place D (the surface of the antenna), it was 1.8 W/m2. The measured values were below ICNIRP guidelines.

General Information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Research group: Environmental Health, Sensing Systems for Wireless Medicine (MediSense), TMI Rauno Pääkkönen, Department of Electrical and Computer Engineering Kagawa National College of Technology, Department of Electrical Energy National Technical University, Kharkiv Polytechnic Institute
Authors: Korpinen, L., Pääkkönen, R., Tarao, H., Okun, O., Sydänheimo, L.
Number of pages: 3
Pages: 1104 - 1106
Publication date: 6 Jul 2015

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Title of host publication: Progress In Electromagnetics Research Symposium, July 6-9, 2015, Prague, Czech Republic
Publisher: Electromagnetics Academy
ISBN (Electronic): 978-1-934142-30-1
Publication series
Name: Progress in electromagnetics research symposium
ISSN (Print): 1559-9450
ASJC Scopus subject areas: Engineering(all), Electrical and Electronic Engineering
Links:
Research output: Scientific - peer-review » Conference contribution
Impact of Bending on the Performance of Circularly Polarized Wearable Antenna

Wearable electronic devices are becoming a part of human clothing for applications such as sensing, navigation and health monitoring. Textile antennas are a strong candidate for transceiver node in wearable applications due to their flexibility and low cost. In wearable systems, flat surfaces are not always available so the antenna should be able to retain its performance in bent conditions. This paper analyses the effects of bending on the performance of a circularly polarized textile antenna. The antenna under test is made on Denim substrate for Industrial, Scientific and Medical (ISM) band and Wireless Body Area Network (WBAN) applications at 2.45 GHz. Copper tape is used as the conductive material for the patch and the ground plane on 1mm thick Denim substrate. Rectangular slot along diagonal axes at the center of the circular patch is used for achieving circular polarization at 2.45 GHz while bandwidth enhancement is done by using partial and slotted ground plane. The measured operating frequency range of antenna spans from 2.42 GHz to 2.58 GHz with gain of 2.25 dB at 2.45 GHz. Bending in both xz and yz plane is done by placing the antenna on cylinders with different radii (50mm and 75mm) and then analyzing the effects on return loss, bandwidth, axial ratio and radiation characteristics. Fabricated antenna shows good conformity between simulated and measured results. A set of comparative results of antenna in free space and bending conditions are compared to validate the operability of antenna with bending in different planes. In future, the performance of antenna can be analyzed on different body parts like arms and legs etc. to validate its operability for BAN applications in vicinity of human body.
Numerical Estimation of Muscle Conductivity in Terms of Human Body Internal Resistance

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Research group: Environmental Health, National Institute of Technology, Kagawa College, Japan, National Technical University
Authors: Tarao, H., Aga, K., Okun, O., Korpinen, L.
Number of pages: 3
Pages: 439 - 441
Publication date: 6 Jul 2015

Possible Methods for Limiting Exposure to the Electric Fields of High Voltage Power Lines on Active Implantable Medical Devices in the Human Body

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Research group: Environmental Health, Sensing Systems for Wireless Medicine (MediSense), Department of Electrical Energy National Technical University, Kharkiv Polytechnic Institute
Authors: Korpinen, L., Okun, O., Sydänheimo, L.
Number of pages: 4
Pages: 1107 - 1110
Publication date: 6 Jul 2015
Evaluating the electrode measurement sensitivity of subdermal electroencephalography electrodes

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Research group: Wireless Identification and Sensing Systems Research Group
Authors: Mendes, M. R., Subramaniyam, N. P., Wendel-Mitoraj, K.
Number of pages: 4
Pages: 1092-1095
Publication date: 1 Jul 2015

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Publisher: IEEE COMPUTER SOCIETY PRESS
ISBN (Print): 9781467363891
ASJC Scopus subject areas: Artificial Intelligence, Mechanical Engineering
DOIs:
10.1109/NER.2015.7146818

Electro-textiles – The enabling technology for wearable antennas in wireless body-centric sensing systems

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Authors: Koski, K., Moradi, E., Hasani, M., Virkki, J., Björninen, T., Rahmat-Samii, Y., Ukkonen, L.
Pages: 1203-1204
Publication date: Jul 2015

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Research output: Scientific - peer-review › Conference contribution

Evaluation of an implantable passive sensor for wireless intracranial pressure monitoring

This paper proposes and evaluates a fully implantable passive sensor for minimally invasive intracranial pressure monitoring. The sensor is inductively linked with an on-body reader coil to detect pressure variations. Evaluation of the sensor proved the capability of highly linear pressure measurement ranging from 0 to 70 mmHg at 5-mmHg intervals.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Research group: Wireless Identification and Sensing Systems Research Group, Department of Electronics and Communications Engineering, Sensing Systems for Wireless Medicine (MediSense)
Authors: Behfar, M., Moradi, E., Björninen, T., Sydänheimo, L., Ukkonen, L.
Pages: 1201-1202
Publication date: Jul 2015
Inkjet-printed monopole antenna and voltage doubler on cardboard for RF energy harvesting

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Research group: Wireless Identification and Sensing Systems Research Group, Sensing Systems for Wireless Medicine (MediSense), Georgia Institute of Technology, School of Electrical and Computer Engineering
Authors: Khonsari, Z., Björninen, T., Sydänheimo, L., Tentzeris, M. M., Ukkonen, L.
Pages: 1312-1313
Publication date: Jul 2015

Possibilities of 3D direct write dispensing for textile UHF RFID tag manufacturing

We outline the possibilities of 3D direct write dispensing in the manufacturing of UHF RFID tags on textile materials and present considerations regarding the process parameters to achieve high-performance tags when the antenna is deposited directly on the rough and porous textile material. We also show that it is possible to use the dispensing to form the antenna-microchip connection using conductive ink only in order to simplify the manufacturing process. Our measurement results confirm that the manufactured textile-based RFID tags achieve high performance with the attainable read ranges of 8.5-to-11 meters in air.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Authors: Björninen, T., Virkki, J., Sydänheimo, L., Ukkonen, L.
Pages: 1316–1317
Publication date: Jul 2015

Self-reported ache, pain, or numbness in hip and lower back and use of computers and cell phones amongst Finns aged 18–65

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Research group: Environmental Health, TMI Rauno Pääkkönen, Department of Public Health Sciences, University of Modena and Reggio Emili
AvanTomography: A compact module for positron emission mammography

In AvanTomography project, a compact, high performance module was developed for axial positron emission mammography, which can be integrated with X-ray mammography. With its axial crystal orientation, AvanTomography can achieve a uniform spatial resolution and eliminate the parallax error by unambiguously detecting the location of the positron annihilation. Compact design of the module enables a cost and space efficient system for breast screening. Various configurations, plate or full ring, can be obtained by using multiple modules, allowing the screening of axillary and mammary regions with a single scanner position. In this project, a 6-module system was constructed and tested with a 22Na point source. Energy calibration was performed and initial measurements for energy resolution were conducted.
An example of scenario-based evaluation of military capability areas

The concept of military capabilities is often used in strategic planning of defense. This study describes an example of scenario-based evaluation of military capability areas using alternative systems. The study concentrates on three capability areas: protection, awareness, and engagement. Evaluations of new systems in realistic but future-oriented scenarios may reveal new possibilities to utilize collaboration of different systems or to replace existing systems with new ones. The study indicates how the combination of UAVs and satellites is the most prominent system compared to UAV or satellite systems to enhance protection, engagement, and awareness capability, especially in the 10-year span. Technology development may reveal unexpected synergies in the utilization of the combination of these two systems. Further work will focus on the application of the methodology in other areas and on the collection of data to analyze the effect of the technology development to the capability areas.

Design and technical evaluation of an implantable passive sensor for minimally invasive wireless intracranial pressure monitoring

Metallization of high density TSVs using super inkjet technology

Filling or metallization of the through silicon vias (TSVs) with the conductive materials to act as vertical electrical interconnections through the wafers, is one of the key steps in the microelectromechanical systems (MEMS) wafer level packaging. Previously, metallization of the vias with inkjet printing technology is demonstrated. However, little attention has been paid to the possibility of metallization of high density TSVs; because drop diameters of conventional inkjet
printers are larger than the top diameter of thin vias. Therefore, in this work we investigate the potential of super inkjet (SIJ) technology with 0.1 femtoliter droplets to metallize the vias with top diameter of 23 µm using three different silver nanoparticle inks. The filling processes are monitored by the observation camera and after the sintering, cross-sections of the vias are studied by the optical and scanning electron microscope (SEM).

**Determining Potentially Unstable Operating Points Using Time-Varying Root-Locus**

The application of time-varying root-locus (TVRL) algorithm for transient analysis of electronic circuits with potentially unstable operating points is presented. The TVRL algorithm calculates the dynamic movement of evolving characteristic equation roots by computing them at a sequence of time instants during the circuit transient. This TVRL indicates the existence of potentially unstable operating points. An LC-filter with Q-enhancement is used as example to demonstrate the dynamics of the circuit characteristic equation roots during power supply transient.

**Electrical and thermal analysis of frequency dependent filamentary switching in printed rectifying diodes**

Filamentary conduction and switching properties are studied in printed rectifying diodes with a poly(triaryl amine) (PTAA) semiconductor layer sandwiched between Cu and Ag electrodes. Formation of conductive filaments caused defective operation of the rectifier at low frequencies. In contrast, the normal operation was restored at high frequencies. Reversible switching was observed between the low and high frequency states. Therefore, it is clear that the operational frequency has a significant effect on the filament formation and switching characteristics. The filamentary conduction was confirmed by lock-in IR thermography and physical defect analysis. The results reveal the existence of filamentary operation in p-type rectifying diodes and clearly demonstrate the effect of the device operation frequency on the switching properties. This has far-reaching implications on the switching properties in similar devices in literature. (C) 2015 Elsevier B.V. All rights reserved.
Comparison of Sintering Methods and Conductive Adhesives for Interconnections in Inkjet-Printed Flexible Electronics

Increasing demands for flexibility and stretchability for electronic devices are driving the research for novel fabrication technologies. Inkjet-printing is one of these novel electronics fabrication techniques studied and developed globally in recent years and it has some interesting benefits over traditional lithography-based techniques, mainly its additive and digital nature. Traditional manufacturing methods are mature techniques and the processes are well defined and optimized for large scale manufacturing and inkjet-printing is not going to replace the lithography as such for large scale manufacturing. Inkjet-printing does, however, enable whole new ways of electronics fabrication, such as high part-to-part customization and 3D processability, which have previously been either very challenging or even impossible.

So far research has focused mainly on inkjet-printing itself and the jetting process is understood fairly well. However, at the moment printed semiconductor materials are far inferior to traditional semiconductor components and can not enable the same level of functionality or connectivity. Hybrid systems, combining the high performance of traditional semiconductor components and benefits of inkjet-printing, are studied as a solution for fabricating high performance devices with novel fabrication techniques. Hybrid systems require the ability to attach external components to the printed structures and this integration was chosen as one of the main topic for this thesis work as it had not been studied previously and the knowledge was required for developing inkjet-printing.

This thesis analyzes inkjet-printed hybrid systems and focuses on system level integration. The work is done on interconnections including both the sintering of metallic nanoparticles as well as external component interconnections and circuit board to circuit board connections. Sintering research is focused on alternative sintering methods to traditional thermal sintering and evaluation of their usability in electronics fabrication. Electrically conductive adhesives are studied as
the main method of forming external connection to components and to other circuit boards.

In the research related to this thesis alternative sintering methods were found to be suitable replacements for traditional thermal sintering with the advantages and disadvantages varying between different technologies. Laser and intense pulsed lighting were generally found to be the most promising techniques for inkjet-printed structures. External connections to traditional surface mounted components as well as other printed circuit boards were also successfully demonstrated in the related publications using electrically conductive adhesive materials. Both the electrical performance and long term reliability of the conductive adhesives were found to be inferior to solder-based interconnections but observations show that the difference is caused by the adhesive material itself, not by the use of inkjet-printing. Thus adhesives can be considered as a viable method for forming external interconnections on inkjet-printed structures.

General information
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Ministry of Education publication type: G5 Doctoral dissertation (article)
Organisations: Department of Electronics and Communications Engineering, Research group: Laboratory for Future Electronics
Authors: Niittynen, J.
Number of pages: 62
Publication date: 24 Apr 2015

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Original language: English

Publication series
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Publisher: Tampere University of Technology
Volume: 1291
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Awarding institution:Tampere University of Technology
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Research output: Collection of articles › Doctoral Thesis

Parametric optimization of inkjet printing and optical sintering of nanoparticle inks
In this paper, the parameters for inkjet-printing and photonic sintering of silver and copper nanoparticle inks on flexible polyimide substrate were studied by manufacturing simple line patterns. The results were then utilized to manufacture passive ultra high frequency (UHF) radio frequency identification (RFID) tag antennas on polyimide substrate. The tag's performance was evaluated by wireless measurements. Tags achieved peak read ranges of 3.6-5.5 meters, which can be considered suitable for practical applications.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Authors: Sipilä, E., Ren, Y., Virkki, J., Sydänheimo, L., Tentzeris, M., Ukkonen, L.
Number of pages: 4
Pages: 1-4
Publication date: 1 Apr 2015

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Title of host publication: 2015 9th European Conference on Antennas and Propagation (EuCAP)
ISBN (Print): 978-88-907018-5-6
Keywords: UHF antennas, antenna radiation patterns, copper, ink jet printing, nanoparticles, radiofrequency identification, silver, sintering, Cu, Si, copper nanoparticle ink, distance 3.6 m to 5.5 m, flexible polyimide substrate, inkjet printing parametric optimization, nanoparticle ink optical sintering, passive UHF radio frequency identification tag antenna, passive ultra high-frequency RFID tag antenna, photonic sintering, silver nanoparticle ink, simple line patterns, Copper, Ink, Photonics, Printing, Radiofrequency identification, Silver, Substrates, RFID, UHF, antenna, inkjet printing, nanoparticle ink, tag
Implementation and wireless readout of passive UHF RFID strain sensor tags based on electro-textile antennas

Sensing capabilities embedded in a passive UHF RFID tag provide a battery-free wireless sensor equipped with a digital identifier. We present an RFID strain sensor tag based on a stretchable antenna made of conductive fabrics. To create an efficient antenna for the sensor tag, we use non-stretchable and highly conductive copper-coated fabric to form the main antenna body and join a section of stretchable conductive fabric by means of sewing with conductive thread. We test wirelessly two different sensors with 1 cm and 3 cm stretchable sections and characterize them in terms of the maximal sensor readout distance and the response of its backscatter strength to the antenna elongation. Our results show that the percentage change in the backscatter strength is in approximately linear relation with the antenna elongation.

General information
State: Published
Authors: Long, F., Zhang, X. D., Björninen, T., Virkki, J., Sydänheimo, L., Chan, Y., Ukkonen, L.
Number of pages: 5
Publication date: Apr 2015

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Publisher: IEEE
ISBN (Print): 978-88-907018-5-6
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Comparison of laser and intense pulsed light sintering (IPL) for inkjet-printed copper nanoparticle layers

General information
State: Published
Organisations: Department of Electronics and Communications Engineering, Research group: Laboratory for Future Electronics, Augmented Human Activities (AHA), TU Chemnitz
Authors: Niittynen, J., Sowade, E., Kang, H., Baumann, R. R., Mäntysalo, M.
Publication date: 6 Mar 2015
Peer-reviewed: Yes

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Scopus rating (2015): SJR 2.057 SNIP 1.684 CiteScore 5.3
Scopus rating (2014): SJR 2.103 SNIP 1.544 CiteScore 4.75
Scopus rating (2013): SJR 1.886 SNIP 1.51 CiteScore 4.06
Scopus rating (2012): SJR 1.458 SNIP 0.896 CiteScore 2.44
Original language: English
ASJC Scopus subject areas: Electrical and Electronic Engineering
Electronic versions:
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10.1038/srep08832
Links:
Antenna design considerations for far field and near field wireless body-centric systems

In this paper we analyze the design and realization of wearable and implantable antennas meant for wireless body-centric systems. Studied wearable antennas exploit electro-textiles, including embroidered textiles and conductive fabrics, for the light-weight and transparent integration with daily clothing. We also present mm-sized implantable loop antennas that are capable of providing electromagnetic power to implant devices from an external on-body loop antenna through near field inductive link.

General information
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Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Research group: Wireless Identification and Sensing Systems Research Group, Sensing Systems for Wireless Medicine (MediSense), Electrical Engineering Department, University of California, Los Angeles (UCLA), University of California, Los Angeles
Authors: Moradi, E., Koski, K., Hasani, M., Rahmat-Samii, Y., Ukkonen, L.
Number of pages: 2
Pages: 59-60
Publication date: 2 Mar 2015

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ISBN (Print): 9781479962815
ASJC Scopus subject areas: Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Computational Theory and Mathematics
DOI: 10.1109/COMPEM.2015.7052555
Source: Scopus
Source-ID: 84926322598
Research output: Scientific - peer-review › Conference contribution

Thermal transport characteristics of human skin measured in vivo using ultrathin conformal arrays of thermal sensors and actuators

Measurements of the thermal transport properties of the skin can reveal changes in physical and chemical states of relevance to dermatological health, skin structure and activity, thermoregulation and other aspects of human physiology. Existing methods for in vivo evaluations demand complex systems for laser heating and infrared thermography, or they require rigid, invasive probes; neither can apply to arbitrary regions of the body, offers modes for rapid spatial mapping, or enables continuous monitoring outside of laboratory settings. Here we describe human clinical studies using mechanically soft arrays of thermal actuators and sensors that laminate onto the skin to provide rapid, quantitative in vivo determination of both the thermal conductivity and thermal diffusivity, in a completely non-invasive manner. Comprehensive analysis of measurements on six different body locations of each of twenty-five human subjects reveal systematic variations and directional anisotropies in the characteristics, with correlations to the thicknesses of the epidermis (EP) and stratum corneum (SC) determined by optical coherence tomography, and to the water content assessed by electrical impedance based measurements. Multivariate statistical analysis establishes four distinct locations across the body that exhibit different physical properties: heel, cheek, palm, and wrist/volar forearm/dorsal forearm. The data also demonstrate that thermal transport correlates negatively with SC and EP thickness and positively with water content, with a strength of correlation that varies from region to region, e.g., stronger in the palmar than in the follicular regions.

General information
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Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Research group: Laboratory for Future Electronics, Frederick Seitz Materials Research Laboratory, Department of Materials Science and Engineering, University of Illinois at Urbana-Champaign, L'Oréal California Research Center, L'Oréal Research and Innovation, Aulnay Sous Bois , Department of Electronics and Communication Engineering, L'Oréal Early Clinical, L'Oréal Digital Incubator
Publication date: 6 Feb 2015
Peer-reviewed: Yes

Publication information
Journal: PLoS One
Volume: 10
Issue number: 2
Radio Frequency Identification (RFID) is a wireless automatic identification technology that utilizes electrically active tags – low-cost and low-power wireless communication devices that let themselves transparently and unobstructively be embedded into everyday objects to remotely track information of the object’s physical location, origin, and ownership. At ultra-high frequencies (UHF), this technology uses propagating electromagnetic waves for communication, which enables the fast identification of tags at large distances. A passive RFID tag includes two main components; a tag antenna and an RFID integrate circuit (tag IC). A passive tag relies solely on the external power harvested from an incident electromagnetic wave to run its circuitry and for data transmission. The passiveness makes the tag maintenance-free, simple, and low-cost, allowing large-scale commercial applications in the supply chain, ticketing, and asset tracking. The future of RFID, however, lies in the transition from traditional embedded applications to wearable intelligent systems, in which the tags are seamlessly integrated with everyday clothing. Augmented with various ambient and biochemical sensors, the tag is capable of detecting physical parameters of its environment and providing continuous monitoring of human vital signs. Tremendous amount of tagged entities establish an intelligent infrastructure that is personalized and tailored to the needs of each individual and ultimately, it recedes into the background of our daily life. Although wearable tags in intelligent systems have the enormous potential to revolutionize the quality of human life, the emerging wearable RFID applications introduce new challenges for designers developing efficient and sophisticated RFID systems. Traditional tag design parameters and solutions will no longer respond to the new requirements. Instead, the whole RF community must adopt new methods and unconventional approaches to achieve advanced wearable tags that are highly transparently integrated into our daily life. In this research work, an empirical as well as a theoretical approach is taken to address the above-mentioned wearable RFID tag challenges. Exploiting new analysis tools in combination with computational electromagnetics, a novel technique to model the human body in UHF applications for initiating the design of optimized wearable tags is developed. Further, fundamental unprecedented UHF characteristics of advanced wearable electronics materials – electro-textiles, are established. As an extremely important outcome of this research work, innovative optimization methodologies for the promotion of novel and advanced wearable UHF antennas are proposed. Particularly, it is evidenced that proper embroidery fabrication techniques have the great potential to realize wearable tag antennas exhibiting excellent RF performance and structural properties for the seamless integration with clothing. The kernel of this research work is the realization of a flexible and fully embroidered passive UHF RFID patch tag prototype achieving optimized performance in close vicinity of the high-permittivity and dissipative human body. Its performance may be considered as a benchmark for future wearable antenna designs. This shows that this research work outcome forms an important contribution to the state of the art and a milestone in the development towards wearable intelligence.
2.4 GHz inkjet-printed RF energy harvester on bulk cardboard substrate

An experimental investigation on the inkjetprinted power harvester for 2.4GHz and review of RF characterization of substrate and printed conductors are presented in this paper. A one stage discrete rectifier based on a voltage doubler structure and a planar monopole antenna are fabricated on cardboard using inkjet printing. The performance of the whole system is examined by measuring the output voltage of the RF power harvester. By the utilization of the proposed idea, the fabrication of low-cost environmentally-friendly battery-less wireless modules is conceivable.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Research group: Wireless Identification and Sensing Systems Research Group, Sensing Systems for Wireless Medicine (MediSense), Aristotle University of Thessaloniki, School of Electrical and Computer Engineering, Georgia Institute of Technology, School of Electrical and Computer Engineering
Authors: Khonsari, Z., Björninen, T., Tentzeris, M. M., Sydänheimo, L., Ukkonen, L.
Number of pages: 3
Pages: 153-155
Publication date: Jan 2015
A Novel Enhanced-Performance Flexible RFID-Enabled Embroidered Wireless Integrated Module for Sensing Applications

A novel wireless embroidered integrated platform for radio frequency identification (RFID)-enabled strain sensing that takes advantage of the nonlinear behavior of the RFID chip impedance as a function of the incident power is introduced. Due to the nonlinearity of the chip impedance as a function of the power, a large variation of chip impedance value and thus a large difference of radar cross section values for appropriately chosen power levels are achieved. Taking advantage of this idea, the sensing parameter is detected by interrogation of the sensor tag using two distinct transmitting power levels and calculating the difference of backscattered response. As a proof of concept, we applied the proposed method for the detection of an embroidered RFID-enabled strain sensor that is fabricated using electrotextiles in order to observe the variations of the magnitude and the corresponding strain levels. The proposed model for the chip impedance helps in predicting the RFID chip impedance variation for different strain conditions, an extremely important issue for RF/RFID modules and packages operating over a wide power dynamic range as well as enabling the accurate estimation of the maximum range of the RFID-enabled sensing modules for the maximum allowable power levels.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
ASJC Scopus subject areas: Electrical and Electronic Engineering
Research output: Scientific - peer-review › Article

Accidents and Close Call Situations Connected to the Use of Mobile Phones in Working-Age People ≥ 50 Years Old

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Research group: Environmental Health, TMI
Rauno Pääkkönen, University of Modena and Reggio Emilia
Authors: Korpinen, L., Pääkkönen, R., Gobba, F.
Number of pages: 3
Pages: 1353-1356
Publication date: 2015
Peer-reviewed: Yes
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Scopus rating (2013): SJR 0.125 SNIP 0.276
Scopus rating (2012): SJR 0.122 SNIP 0.234
Scopus rating (2011): SJR 0.117 SNIP 0.165
Scopus rating (2010): SJR 0.109 SNIP 0.111
Original language: English
ASJC Scopus subject areas: Electrical and Electronic Engineering
Research output: Scientific - peer-review › Article
A Rapid Switch Bridge Selection Method for Fully Integrated DC/DC Buck Converters

This letter presents a method for optimum selection of synchronous buck converter switch bridge topology and devices in the CMOS technology of choice. The comparative method targets maximum power efficiency, and it assumes an application where the dc/dc converter is on the same IC as the load with a known constant operating point. As its principal idea, the method circumvents the need for exhaustive comparative simulation work to cover the vast design space of available MOS device and cascode/noncascode topology combinations. Instead, the method narrows the space by using a set of basic parameters to approximate the best combination. The result, thus, provides sharp focus for subsequent detailed design and topology-dependent optimization. The method is illustrated by comparing its results to simulations of synchronous 3.3-1.65-V buck converters in 45 and 65-nm CMOS with core, I/O, and high-voltage devices.
Backscattering neural tags for wireless brain-machine interface systems

Brain-machine interface (BMI) technology has tremendous potential to revolutionize healthcare by greatly improving the quality of life of millions of people suffering from a wide variety of neurological conditions. Radio-frequency identification (RFID)-inspired backscattering is a promising approach for wireless powering of miniature neural sensors required in BMI interfaces. We analyze the functionality of millimeter-size loop antennas in the wireless powering of miniature cortical implants through measurements in a human head equivalent liquid phantom and in the head of a postmortem pig. For the first time, we present the design and measurement of a miniature 1×1×1 mm3 backscattering device based on a cubic loop connected with an RFID integrated circuit (IC). Our measurement results show that this very small loop receives sufficient electromagnetic power to activate the IC when the device is implanted in a pig's head. This demonstrates the feasibility of extremely small implant antennas in challenging wireless biomedical systems.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Authors: Moradi, E., Amendola, S., Björninen, T., Sydänheimo, L., Carmena, J. M., Rabaey, J. M., Ukkonen, L.
Number of pages: 8
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Journal: IEEE Transactions on Antennas and Propagation
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Scopus rating (2015): SJR 1.841 SNIP 2.526 CiteScore 3.48
Scopus rating (2014): SJR 1.828 SNIP 2.644 CiteScore 3.36
Scopus rating (2013): SJR 1.536 SNIP 2.256 CiteScore 3.65
Scopus rating (2012): SJR 1.471 SNIP 2.237 CiteScore 3.63
Scopus rating (2011): SJR 1.366 SNIP 2.16 CiteScore 3.42
Scopus rating (2010): SJR 1.141 SNIP 2.097
Scopus rating (2009): SJR 1.505 SNIP 2.188
Scopus rating (2008): SJR 1.165 SNIP 2.062
Biodegradable passive resonance sensor: Fabrication and initial testing

Biodegradable resonance circuits were studied. The circuits have a novel two-layer resonator structure without galvanic through hole vias. A patterned magnesium layers were evaporated on biodegradable PLA sheets by using a 3D printed mask. The circuits were assembled by heat sealing two magnesium patterned sheets together to encapsulate the circuit structure. An inductive link is used to wirelessly detect the resonance frequency of the circuit. The circuits were tested when immersed in de-ionised water and saline. According to the tests, the designed resonator structure can be measured in aqueous environment. The resonance of the tested circuit was observable at least for 51 hours. The concept still needs more development to extend degradation time and to increase the stability during immersion.
Brush-painted silver UHF RFID tags on environmental-friendly and flexible substrates

In this study, green and flexible materials (cardboard, fabric, and paper) were utilized as substrates for brush-painted silver passive UHF RFID tag antennas. These novel environmental-friendly and flexible tags achieved maximum read ranges of 8.5–12 meters, suggesting good suitability of brush-painting for the manufacturing of future green wireless devices.

General information
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Ministry of Education publication type: A4 Article in a conference publication
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Number of pages: 2
Pages: 1314-1315
Publication date: 2015

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DOIs:
10.1109/APS.2015.7305046
Source: RIS
Source-ID: urn:C3F6450692F6E5BB5701B37F58D26985
Research output: Scientific - peer-review » Conference contribution

Comparison of methods to define power line and substation's busbar wire capacitances in electric field calculation task

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Research group: Environmental Health, National Technical University
Authors: Okun, O., Korpinen, L.
Number of pages: 6
Pages: 55-61
Publication date: 2015
Peer-reviewed: Yes

Publication information
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Volume: Supplement, VII
Issue number: 2(1)
ISSN (Print): 1313-860X
Original language: English
ASJC Scopus subject areas: Electrical and Electronic Engineering
Links:
http://goo.gl/tZgar9
Research output: Scientific - peer-review » Article

DC-DC Converter Power Stage With Cascoded Transistors And Automatic Dead Time Generation

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Research group: RF Integrated Circuits
Authors: Filanovsky, I., Järvenhaara, J., Tchamov, N.
Publication date: 2015

Host publication information
Design and Evaluation of Correlation Accelerator in IEEE-802.11a/g Receiver using a Template-based Coarse-Grained Reconfigurable Array

This paper presents the design and evaluation of a large scale template-based Coarse-Grained Reconfigurable Array (CGRA) generated accelerator that processes correlation algorithm for Timing Synchronization (TS) required in Orthogonal Frequency-Division Multiplexing (OFDM) receivers. The CGRA works as a coprocessor with a Reduced Instruction-Set Computing (RISC) processor. The CGRA accelerator is composed of 80 reconfigurable Processing Elements (PEs) to compute 80-point correlation in 1.8 μs when synthesized on an Field Programmable Gate Array (FPGA). The power consumption is estimated by simulating the postfit gate-level FPGA netlist of the TS accelerator followed by evaluation and comparison with other state-of-the-art platforms in terms of multiple performance metrics.

Design and Implementation of a Power-aware FFT Core for OFDM-based DSA-enabled Cognitive Radios

This research work presents the design and the physical implementation of a power aware FFT core for OFDM-based, dynamic spectrum access (DSA) enabled cognitive radios. The FFT core is equipped with a pruning engine that allows the run-time removal of dummy operations (e.g. multiplications by a zero term) related to the pruning of sub-carriers of the communication systems. The pruning algorithm introduced by this research work utilizes a reduced size configuration matrix, which limits the memory requirements’ overhead. Finally, the physical implementation of the FFT on a 45 nm technology node showed that, for a 8 % area overhead, the total power saving settles around 10 % when in the presence of a medium to high pruning level, justifying the silicon area overhead introduced by the pruning unit.
Design and Implementation of Fully 3D Miniaturized Passive UHF RFID Tag for Sensing Applications

In this paper, we present a 3D passive UHF RFID tag that is fabricated utilizing direct write printing method. The dual antennas tag is printed using the dispensing technique on a wooden cube with dimension of 8 cm³ (2 cm × 2 cm × 2 cm), which is the smallest RFID tag fabricated in 3D structure so far. The narrow-line tag antenna has a near-isotropic radiation pattern which enabling the tag with full visibility. The antenna design and design parameters are quantified using numerical simulations. A prototype model of tag is manufactured to validate the simulation model. The simulation and measurements results show the read range about 2 m (100 times the tag dimension) in 360˚ around the tag.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Authors: Hasani, M., Sydänheimo, L., Ukkonen, L.
Publication date: 2015

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Title of host publication: 2015 Loughborough Antennas & Propagation Conference (LAPC)
Publisher: IEEE
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Research output: Scientific - peer-review » Conference contribution

Design, Implementation and Analysis of a Run-time Configurable Memory Management Unit on FPGA

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Research group: System-on-Chip for GNSS, Wireless Communications and Cyber-Physical Embedded Computing, Department of Electronics and Communications Engineering, Wireless Communications and Positioning (WICO)
Authors: Shamani, F., Fakour Sevom, V., Nurmi, J., Ahonen, T.
Publication date: 2015
Embroidered Textile Antennas for Wireless Body-Centric Communication and Sensing

This paper presents a review and analysis of embroidered textile antennas for wireless body-centric communication systems. Especially, the paper concentrates on recent advancements in embroidered on-body radio frequency identification (RFID) antennas and wireless brain machine interface (BMI) systems and their specific antenna and wireless power transfer challenges.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Research group: Wireless Identification and Sensing Systems Research Group, Sensing Systems for Wireless Medicine (MediSense), University of California, Los Angeles
Authors: Ukkonen, L., Sydänheimo, L., Rahmat-Samii, Y.
Publication date: 2015

Ergonomics Aspects of Work with Computers

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Research group: Environmental Health, University of Modena and Reggio Emilia
Authors: Korpinen, L., Pääkkönen, R., Gobba, F.
Number of pages: 5
Pages: 2290-2294
Publication date: 2015
Peer-reviewed: Yes

Publication information
Journal: International Journal of Social, Behavioral, Educational, Economic and Management Engineering
Volume: 9
Issue number: 9
ISSN (Print): 2010-376X
Ratings:
Scopus rating (2014): SJR 0.132 SNIP 0.323
Scopus rating (2013): SJR 0.125 SNIP 0.276
Scopus rating (2012): SJR 0.122 SNIP 0.234
Scopus rating (2011): SJR 0.117 SNIP 0.165
Scopus rating (2010): SJR 0.109 SNIP 0.111
Original language: English
ASJC Scopus subject areas: Electrical and Electronic Engineering
Links:
Research output: Scientific - peer-review › Article
Example measurements of exposure to ELF magnetic fields on the metro station in Finland

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Research group: Environmental Health, Helsinki City Transport, Combinova, Rejlers Oy
Authors: Korpinen, L., Lähdetie, A., Amundin, Å., Piippo, H., Sydänheimo, L.
Number of pages: 4
Pages: 250-253
Publication date: 2015
Peer-reviewed: Yes

Publication information
Journal: Bulgarian journal of public health
Volume: Supplement, VII
Issue number: 2(1)
ISSN (Print): 1313-860X
Original language: English
ASJC Scopus subject areas: Electrical and Electronic Engineering
Links:
http://goo.gl/tZgar9
Research output: Scientific - peer-review › Article

Examples of occupational exposure to electric and magnetic fields at 110-kV gas-insulated substations (GISs)

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Research group: Environmental Health, TMI
Authors: Korpinen, L., Pääkkönen, R.
Number of pages: 4
Pages: 394-397
Publication date: 2015
Peer-reviewed: Yes

Publication information
Journal: Radiation Protection Dosimetry
Volume: 163
Issue number: 3
ISSN (Print): 0144-8420
Ratings:
Scopus rating (2016): SJR 0.444 SNIP 0.727 CiteScore 0.86
Scopus rating (2015): SJR 0.466 SNIP 0.832 CiteScore 0.82
Scopus rating (2014): SJR 0.517 SNIP 0.913 CiteScore 0.89
Scopus rating (2013): SJR 0.538 SNIP 0.815 CiteScore 0.9
Scopus rating (2012): SJR 0.556 SNIP 0.801 CiteScore 0.82
Scopus rating (2011): SJR 0.541 SNIP 1.049 CiteScore 0.96
Scopus rating (2010): SJR 0.574 SNIP 0.802
Scopus rating (2009): SJR 0.475 SNIP 0.75
Scopus rating (2008): SJR 0.586 SNIP 1.022
Scopus rating (2007): SJR 0.483 SNIP 1.011
Scopus rating (2006): SJR 0.372 SNIP 0.705
Scopus rating (2005): SJR 0.401 SNIP 0.723
Scopus rating (2004): SJR 0.428 SNIP 0.842
Scopus rating (2003): SJR 0.341 SNIP 0.523
Scopus rating (2002): SJR 0.45 SNIP 0.834
Scopus rating (2001): SJR 0.476 SNIP 0.899
Scopus rating (2000): SJR 0.464 SNIP 0.748
Scopus rating (1999): SJR 0.465 SNIP 0.929
Examples of the Teaching of the Health Questions of Electric and Magnetic Fields at Tampere University of Technology in Finland

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Research group: Environmental Health
Authors: Korpinen, L., Pääkkönen, R.
Number of pages: 6
Pages: 277-282
Publication date: 2015
Peer-reviewed: Yes

Publication information
Journal: Journal of Physical Science and Application
Volume: 5
Issue number: 4
ISSN (Print): 2159-5348
Original language: English
ASJC Scopus subject areas: Electrical and Electronic Engineering
DOI:
10.17265/2159-5348/2015.04.005
Research output: Scientific - peer-review › Article

Exposure to RF fields during the remote readings of the smart meter in Finland

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Research group: Environmental Health, TMI
Rauno Pääkkönen
Authors: Pääkkönen, R., Lundström, M., Mustaparta, J., Korpinen, L.
Number of pages: 3
Pages: 69-71
Publication date: 2015
Peer-reviewed: Yes

Publication information
Journal: Bulgarian journal of public health
Volume: Supplement, VII
Issue number: 2(1)
ISSN (Print): 1313-860X
Original language: English
ASJC Scopus subject areas: Electrical and Electronic Engineering
Links:
http://goo.gl/tZgar9
Research output: Scientific - peer-review › Article

Flash Reduction of Inkjet Printed Graphene Oxide on Flexible Substrates for Electronic Applications
Graphene based nanomaterials open a new horizon in the electronic devices due to the unique and superior properties of graphene. The deposition of graphene based materials has significant effects on their final properties. Moreover, deposited graphene based samples are reduced by chemical or thermal reduction methods. To save time and energy compared to conventional approaches, advanced methods such as photonic curing have been recently developed and reported. The aim of our study is to fabricate thin layer of reduced graphene oxide on the flexible substrate which can be used as a sensing part in mechanical, environmental or biological sensors. The graphene oxide dispersion in deionized water was inkjet printed on oxygen plasma treated polyimide substrate (Kapton, TM), and then reduced by Xenon flash. The energy of each pulse, pulse amplitude and width were adjusted to achieve the optimum flash settings for inkjet-printed graphene oxide. The cured samples were characterized to observe influence of different processing conditions of the
reduced GO films.

**General information**

State: Published

Ministry of Education publication type: A4 Article in a conference publication

Organisations: Department of Electronics and Communications Engineering, Research group: Wireless Identification and Sensing Systems Research Group

Authors: Akbari, M., Sydänheimo, L., Juuti, J., Ukkonen, L.

Publication date: 2015

**Host publication information**

Title of host publication: IEEE NANO 2015 - 15th International Conference on Nanotechnology, 27-30 July 2015, Rome, Italy

Publisher: IEEE

ISBN (Print): 978-1-4673-8156-7

DOIs: 10.1109/NANO.2015.7388775

Research output: Scientific - peer-review › Conference contribution

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**Head-mounted Display with Mid-air Tactile Feedback**

**General information**

State: Published

Ministry of Education publication type: A4 Article in a conference publication

Organisations: Department of Electronics and Communications Engineering, Research group: Personal Electronics Group, Augmented Human Activities (AHA), University of Tampere

Authors: Sand, A., Rakkolainen, I., Isokoski, P., Kangas, J., Raisamo, R., Palovuori, K.

Number of pages: 8

Pages: 51-58

Publication date: 2015

**Host publication information**

Title of host publication: Proceedings of the 21st ACM Symposium on Virtual Reality Software and Technology

Place of publication: New York, NY, USA

Publisher: ACM

ISBN (Print): 978-1-4503-3990-2

Keywords: 3D interaction, 3D user interfaces, augmented reality, gestures, head-mounted display, mid-air tactile feedback, virtual reality

DOIs: 10.1145/2821592.2821593

Links:

http://doi.acm.org/10.1145/2821592.2821593

**Bibliographical note**

EXT="Rakkolainen, Ismo"

Source: Bibtex

Source-ID: urn:9e6af6662b229d0155017e4d0f53926e

Research output: Scientific - peer-review › Conference contribution

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**Health surveillance according to the new EU directive 2013/35/EU: possible criteria**

**General information**

State: Published

Ministry of Education publication type: A1 Journal article-refereed

Organisations: Department of Electronics and Communications Engineering, Research group: Environmental Health, University of Modena and Reggio Emilia

Authors: Korpinen, L., Gobba, F.

Number of pages: 3

Pages: 127-129

Publication date: 2015

Peer-reviewed: Yes

**Publication information**

Journal: Bulgarian journal of public health
Improved Interaction for Mid-Air Projection Screen Technology

General information
State: Published
Ministry of Education publication type: A3 Part of a book or another research book
Organisations: Department of Electronics and Communications Engineering, Research group: Personal Electronics Group, Augmented Human Activities (AHA), University of Tampere, School of Information Sciences
Authors: Palovuori, K., Rakkolainen, I.
Number of pages: 20
Pages: 84-103
Publication date: 2015

Host publication information
Title of host publication: Handbook of Research on Interactive Information Quality in Expanding Social Network Communications
Publisher: IGI Global
ISBN (Print): 978-1-46667-377-9
DOIs: 10.4018/978-1-4666-7377-9.ch006
Research output: Scientific - peer-review › Chapter

Inkjet-printed push-buttons for epidermal electronics

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Electronics and Communications Engineering, Research group: Laboratory for Future Electronics
Authors: Vuorinen, T., Niittynen, J., Kankkunen, T., Lammi, T., Mäntysalo, M.
Number of pages: 5
Pages: 67-71
Publication date: 2015

Host publication information
Title of host publication: Printing Future Days 2015 : 6th International Scientific Conference on Print and Media Technology
Publisher: Verlag für Wissenschaft und Bildung VWB
ISBN (Print): 978-3-86135-626-4

Bibliographical note
AUX=elt,"Kankkunen, Timo"
AUX=elt,"Lammi, Toni"
Research output: Scientific - peer-review › Conference contribution

Inkjet-printed wideband planar monopole antenna on cardboard for RF energy-harvesting applications

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Authors: Saghlatoon, H., Björninen, T., Sydänheimo, L., Tentzeris, M. M., Ukkonen, L.
Number of pages: 4
Pages: 325-328
Publication date: 2015
Measurements of magnetic fields and contact currents produced by domestic induction hobs

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Research group: Environmental Health, University of Miyazaki, University of Tokushima
Authors: Tarao, H., Korpinen, L., Hayashi, N., Isaka, K.
Number of pages: 3
Pages: 112-114
Publication date: 2015
Peer-reviewed: Yes

Publication information
Journal: Bulgarian journal of public health
Volume: Supplement, VII
Issue number: 2(1)
ISSN (Print): 1313-860X
Original language: English
ASJC Scopus subject areas: Electrical and Electronic Engineering
Links: http://goo.gl/tZgar9
Research output: Scientific - peer-review › Article

Occupational and environmental exposure to extremely low frequency magnetic fields in a large group of workers

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Research group: Environmental Health, University of Modena and Reggio Emilia, Italian Worker's Compensation Authority (INAIL), Italian Ministry of Health
Authors: Gobba, F., Rossi, P., Bravo, G., Contessa, G. M., Korpinen, L.
Number of pages: 3
Pages: 211-213
Publication date: 2015
Peer-reviewed: Yes

Publication information
Operation and Design of VHF Self-Oscillating DC-DC Converter with Integrated Transformer

The paper presents a self-oscillating DC-DC integrated converter which is operable in the frequency range of 200MHz-260MHz. The circuit includes a cascoded power stage, an integrated transformer, duty-cycle detector, and pulse shaper. The primary of the transformer provides the transmission of power to the converter load. The secondary, via detector and shaper, provides the feedback signal to the gates of cascoded transistors in the power stage. A detailed analysis of the converter operation is given. The conditions for a smooth start-up are indicated as well. The converter layout is provided. The circuit was designed and simulated in 45 nm CMOS technology, and the calculated operation parameters are compared with that of the extracted from layout converter.

Possibility to decreasing the 50Hz electric field exposure with different jackets

The study investigates the potential to reduce the 50Hz electric field exposure using different jackets. The research was conducted by Korpinen, L., and Pääkkönen, R., from the Department of Electronics and Communications Engineering, with a focus on Environmental Health. The jackets were evaluated for their effectiveness in decreasing exposure levels.
Possible Exposure of Persons with Cardiac Pacemakers to Extremely Low Frequency (ELF) Electric and Magnetic Fields

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Research group: Environmental Health, University of Modena and Reggio Emilia, Tampere University Hospital
Authors: Korpinen, L., Pääkkönen, R., Gobba, F., Virtanen, V.
Number of pages: 7
Pages: 344-347
Publication date: 2015
Peer-reviewed: Yes

Preliminary measurements of smart meter electromagnetic field (50-100kHz) emissions in Finland

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Research group: Environmental Health, TMI Rauno Pääkkönen
Authors: Pääkkönen, R., Lundström, M., Mustaparta, J., Korpinen, L.
Number of pages: 3
Pages: 66-68
Publication date: 2015
Peer-reviewed: Yes
Printed hybrid systems for healthcare

General information
State: Published
Ministry of Education publication type: D1 Article in a trade journal
Organisations: Department of Electronics and Communications Engineering, Research group: Laboratory for Future Electronics
Authors: Mäntysalo, M., Vuorinen, T., Nurmentaus, S.
Number of pages: 2
Pages: 8-9
Publication date: 2015
Peer-reviewed: Unknown

Publication information
Journal: OPE Journal
Issue number: 11
Original language: English
Research output: Professional Article

The effects of recurrent stretching on the performance of electro-textile and screen-printed ultra-high-frequency radio-frequency identification tags

Future welfare and healthcare applications require wearable radio-frequency identification (RFID) tags where the tag antenna is an integral part of clothing and endures repeated stretching. In this study, wearable passive ultra-high-frequency (UHF) RFID tag antennas were fabricated from silver-plated stretchable fabric and by screen printing them on non-conductive, stretchable fabric. The reliability of the tags was studied by stretching them repeatedly from the initial length of 10 cm to 13.5 cm, up to 200 stretching cycles. According to our results, the electro-textile tags achieved read ranges of 6.5 meters, also after the 200 harsh stretches. The screen-printed tags initially achieved read ranges of 9.5 meters and after the 200 stretches the read ranges were only 2.5 meters shorter, that is, still about 7 meters. These measurement results and the strengths and weaknesses of both types of wearable tags are discussed in this paper.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Authors: Virikki, J., Björninen, T., Merilampi, S., Sydänheimo, L., Ukkonen, L.
Publication date: 2015
Peer-reviewed: Yes
The heat is on: thermal input for immaterial interaction

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Research group: Personal Electronics Group, Augmented Human Activities (AHA), University of Tampere, School of Information Sciences
Authors: Palovuori, K., Rakkolainen, I.
Number of pages: 3
Pages: 152-154
Publication date: 2015

Host publication information
Title of host publication: Proceedings of the 19th International Academic MindTrek Conference 2015
Publisher: ACM
ISBN (Electronic): 978-1-4503-3948-3
DOIs:
10.1145/2818187.2818272
Research output: Scientific - peer-review › Conference contribution

Thermal Management in Long-Wavelength Flip-Chip Semiconductor Disk Lasers

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Optoelectronics Research Centre, Research group: Ultrafast and intense lasers, Research group: Laboratory for Future Electronics, Department of Electronics and Communications Engineering, Research group: Surface
**Stand-alone GNSS time synchronization architecture**

It is well known property of the GNSS systems that they are able to deliver very precise Position, Velocity and Time information to the user. In this paper we introduce a GNSS receiver architecture, which is able to synchronize its operations to the GNSS signals it processes, be it live satellite signals or simulator signals, without the need of external synchronization equipment. This capability is useful for testing the receiver with GNSS simulators, and can also be used for synchronizing a set of GNSS receivers. Since the architecture does not need any external synchronization signals, it is convenient to move the GNSS receiver between testing premises. Most commercially available GNSS simulators can output some format of scenario information, and this scenario information is by default bound to be ticked on exact full second intervals according to the simulator clock. Having a receiver capable of doing the synchronization to the same time allows the receiver output its own measurements at the same time instants, making the comparisons extremely useful.

**General information**

State: Published

Ministry of Education publication type: A4 Article in a conference publication

Organisations: Department of Electronics and Communications Engineering, Research group: System-on-Chip for GNSS, Wireless Communications and Cyber-Physical Embedded Computing, Wireless Communications and Positioning (WICO)

Authors: Paakki, T., Della Rosa, F., Nurmi, J.

Number of pages: 4

Pages: 1-4

Publication date: 1 Dec 2014

**Host publication information**

Title of host publication: 2014 7th ESA Workshop on Satellite Navigation Technologies and European Workshop on GNSS Signals and Signal Processing (NAVITEC)

Publisher: IEEE

ISBN (Print): 978-1-4799-6529-8

Keywords: satellite navigation, signal processing, GNSS receiver architecture, GNSS signals, GNSS simulators, stand-alone GNSS time synchronization architecture, Global Positioning System, Hardware, Receivers, Satellites, Software, Synchronization, Satellite navigation systems

DOIs: 10.1109/NAVITEC.2014.7045142

Source: Bibtex

Source-ID: urn:f4eacc0019896378812316ed62b80598

Research output: Scientific - peer-review › Conference contribution

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**A Minimally Invasive 64-Channel Wireless μeCoG Implant**

Emerging applications in brain-machine interface systems require high-resolution, chronic multisite cortical recordings, which cannot be obtained with existing technologies due to high power consumption, high invasiveness, or inability to transmit data wirelessly. In this paper, we describe a microsystem based on electrocorticography (ECoG) that overcomes these difficulties, enabling chronic recording and wireless transmission of neural signals from the surface of the cerebral cortex. The device is comprised of a highly flexible, high-density, polymer-based 64-channel electrode array and a flexible antenna, bonded to 2.4 mm × 2.4 mm CMOS integrated circuit (IC) that performs 64-channel acquisition, wireless power and data transmission. The IC digitizes the signal from each electrode at 1 kS/s with 1.2 μV input referred noise, and transmits the serialized data using a 1 Mb/s backscattering modulator. A dual-mode power-receiving rectifier reduces data-dependent supply ripple, enabling the integration of small decoupling capacitors on chip and eliminating the need for external components. Design techniques in the wireless and baseband circuits result in over 16× reduction in die area with a simultaneous 3× improvement in power efficiency over the state of the art. The IC consumes 225 μW and can be powered by an external reader transmitting 12 mW at 300 MHz, which is over 3× lower than IEEE and FCC regulations.

**General information**

State: Published

Ministry of Education publication type: A1 Journal article-refereed


Authors: Muller, R., Le, H. P., Li, W., Ledochowitsch, P., Gambini, S., Björnen, T., Koralek, A., Carmen, J. M., Mahabirz, M. M., Alon, E., Rabaey, J. M.

Number of pages: 16

Pages: 344-359

Publication date: 21 Nov 2014

Peer-reviewed: Yes
Low-cost, solution processable carbon nanotube supercapacitors and their characterization

We report ecological and low-cost carbon nanotube (CNT) supercapacitors fabricated using a simple, scalable solution processing method, where the use of a highly porous and electrically conductive active material eliminates the need for a current collector. Electrodes were fabricated on a poly(ethylene terephthalate) substrate from a printable multi-wall CNT ink, where the CNTs are solubilized in water using xylan as a dispersion agent. The dispersion method facilitates a very high concentration of CNTs in the ink. Supercapacitors were assembled using a paper separator and an aqueous NaCl electrolyte and the devices were characterized with a galvanostatic discharge method defined by an industrial standard. The capacitance of the 2 cm(2) devices was 6 mF/cm(2) (2.3 F/g) and equivalent series resistance 80 Ω. Low-cost supercapacitors fabricated from safe and environmentally friendly materials have potential applications as energy storage devices in ubiquitous and autonomous intelligence as well as in disposable low-end products.

General information

State: Published

Ministry of Education publication type: A1 Journal article-refereed

Organisations: Department of Electronics and Communications Engineering, Department of Materials Science, Research group: Materials Characterization, Augmented Human Activities (AHA), Engineering materials science and solutions (EMASS)

Authors: Lehtimäki, S., Tuukkanen, S., Pörhönen, J., Moilanen, P., Virtanen, J., Honkanen, M., Lupo, D.
Number of pages: 6
Pages: 1329-1334
Publication date: Nov 2014
Peer-reviewed: Yes

Publication information

Volume: 117
Issue number: 3
ISSN (Print): 0947-8396
Printable, Transparent, and Flexible Touch Panels Working in Sunlight and Moist Environments

The ongoing revolution of touch-based user interfaces sets new requirements for touch panel technologies, including the need to operate in a wide range of environments. Such touch panels need to endure moisture and sunlight. Moreover, they often need to be curved or flexible. Thus, there is a need for new technologies suitable, for example, for home appliances used in the kitchen or the bathroom, automotive applications, and e-paper. In this work, the development of transparent and flexible touch panels for moist environments is reported. A piezoelectric polymer, poly(vinylidene difluoride) (PVDF), is used as a functional substrate material. Transparent electrodes are fabricated on both sides of a PVDF film using a graphene-based ink and spray coating. The excellent performance of the touch panels is demonstrated in moist and underwater conditions. Also, the transparent device shows very small pyroelectric response to radiative heating in comparison to a non-transparent device. Solution processable electrode materials in combination with functional substrates allow the low-cost and high-throughput manufacturing of touch panels using printing technologies.
Performance of printable supercapacitors in an RF energy harvesting circuit

We report the fabrication of a supercapacitor on a plastic substrate with mass-production-compatible methods and its characterisation using galvanostatic and voltammetric methods. The supercapacitor is prepared in ambient conditions using activated carbon and an aqueous, non-acidic electrolyte. The obtained capacitances are 0.45 F and 0.21 F for device sizes of 4 cm² and 2 cm², respectively. Additionally, we demonstrate the utilisation of the supercapacitor in an autonomous energy harvesting and storage system. The RF energy harvester comprises a printed loop antenna and a half-wave organic diode rectifier operating at 13.56 MHz frequency. The harvested energy is stored in two supercapacitors connected in series to increase the maximum operating voltage. In order to power a device such as a sensor or a small indicator display, voltage regulation is needed. A voltage regulator, implemented as an application specific integrated circuit (ASIC), was designed for this purpose, and fabricated commercially. We demonstrate the ability of the harvester storage unit to power the regulator for hours with a constant regulator output voltage and power. The effect of supercapacitor charging time on the actual supercapacitor charging state is also discussed, as a slower charging rate is found to have a significant effect on the output of the supercapacitor. (C) 2014 Elsevier Ltd. All rights reserved.
Stretching of solution processed carbon nanotube and graphene nanocomposite films on rubber substrates

The fabrication and characterization of stretchable carbon nanotube and graphene nanocomposite electrodes on different rubber substrates is reported. Electrodes are fabricated at low temperatures using solution processable carbon nanomaterials. Rubber substrates are stretched while performing simultaneous electrical measurements for the electrodes. During 20% elongation of rubber substrates a 2- to 120-fold increase in the electrode resistance was observed, depending on the sample. The relative increase in the resistance with stretching was smaller in the case of graphene electrodes, whereas the resistance change during the elastomer relaxation was smaller in the case of carbon nanotube electrodes. Our results suggest that solution processed carbon nanomaterials on rubber substrates have potential for stretchable wiring and sensor applications. (C) 2014 Elsevier B.V. All rights reserved.

General information

State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Department of Materials Science, Research group: Materials Characterization, Research group: Laboratory for Future Electronics, Research group: Plastics and Elastomer Technology, Augmented Human Activities (AHA), Engineering materials science and solutions (EMASS), Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Tuukkanen, S., Hoikkanen, M., Poikelispää, M., Honkanen, M., Vuorinen, T., Kakkonen, M., Vuorinen, J., Lupo, D.
Number of pages: 8
Pages: 28-35
Publication date: May 2014
Peer-reviewed: Yes

Publication information

Journal: Synthetic Metals
Volume: 191
ISSN (Print): 0379-6779
Ratings:
Advances in antenna designs for UHF RFID tags mountable on conductive items

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Sensing Systems for Wireless Medicine (MediSense)
Authors: Björninen, T., Sydänheimo, L., Ukkonen, L., Rahmat-Samii, Y.
Number of pages: 25
Pages: 79-103
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: IEEE Antennas and Propagation Magazine
Volume: 56
Issue number: 1
ISSN (Print): 1045-9243
Ratings:
Scopus rating (2016): CiteScore 1.38 SJR 0.632 SNIP 1.202
Scopus rating (2015): SJR 0.861 SNIP 1.46 CiteScore 1.29
Scopus rating (2014): SJR 0.913 SNIP 1.364 CiteScore 1.26
Scopus rating (2013): SJR 0.625 SNIP 1.288 CiteScore 1.24
A Fully Inkjet-Printed Chipless RFID Gas and Temperature Sensor on Paper

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Sensing Systems for Wireless Medicine (MediSense)
Authors: Vena, A., Sydänheimo, L., Ukkonen, L., Tentzeris, M. M.
Number of pages: 6
Pages: 115-120
Publication date: 2014

Host publication information
Title of host publication: 2014 IEEE RFID Technology and Applications Conference, 8-9 September 2014, Tampere, Finland
Publisher: Institute of Electrical and Electronics Engineers IEEE
ISBN (Print): 978-1-4799-4680-8

Bibliographical note
Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2014-06-02<br/>Publisher name: Institute of Electrical and Electronics Engineers IEEE
Source: researchoutputwizard
Source-ID: 175

Research output: Scientific - peer-review › Article

A Fully Inkjet-Printed Wireless and Chipless Sensor for CO2 and Temperature detection

A study on a low-cost wireless fully inkjet-printed chipless sensor on a flexible laminate with three different inks is presented. It is based on two split ring resonator 90° oriented between each other to allow for independent responses on two polarizations. A deposit of a polymer/single walled carbon nanotube composite ink is used to allow for the detection of CO2 as well as temperature. In this paper, it is shown that the inkjet printing of a polymer-based coating on top of the sensing/reactive deposit can significantly reduce the sensitivity to CO2, whereas the temperature sensitivity stays at same. Simulations and experimental results verify the repeatability of this topology.
A Health-IoT Platform Based on the Integration of Intelligent Packaging, Unobtrusive Bio-Sensor, and Intelligent Medicine Box

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Sensing Systems for Wireless Medicine (MediSense)
Authors: Vena, A., Sydänheimo, L., Tentzeris, M. M., Ukkonen, L.
Number of pages: 11
Pages: 89-99
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: IEEE Sensors Journal
Volume: 15
Issue number: 1
ISSN (Print): 1530-437X
Ratings:
Scopus rating (2016): CiteScore 3.12 SJR 0.706 SNIP 1.689
Scopus rating (2015): SJR 0.684 SNIP 1.908 CiteScore 2.85
Scopus rating (2014): SJR 0.799 SNIP 1.934 CiteScore 2.5
Scopus rating (2013): SJR 0.666 SNIP 1.811 CiteScore 2.6
Scopus rating (2012): SJR 0.602 SNIP 1.445 CiteScore 2.09
Scopus rating (2011): SJR 0.572 SNIP 1.421 CiteScore 2.13
Scopus rating (2010): SJR 0.533 SNIP 1.077
Scopus rating (2009): SJR 0.631 SNIP 1.351
Scopus rating (2008): SJR 0.641 SNIP 1.371
Scopus rating (2007): SJR 0.785 SNIP 1.484
Scopus rating (2006): SJR 0.631 SNIP 1.627
Scopus rating (2005): SJR 0.596 SNIP 1.968
Scopus rating (2004): SJR 0.772 SNIP 1.934
Scopus rating (2003): SJR 0.622 SNIP 2.018
Scopus rating (2002): SJR 0.465 SNIP 2.1
Original language: English
DOIs: 10.1109/JSEN.2014.2336838

Bibliographical note
Contribution: organisation=elt,FACT1=1
Portfolio EDEND: 2014-08-30
Publisher name: Institute of Electrical and Electronics Engineers IEEE
Source: researchoutputwizard
Source-ID: 1717
Research output: Scientific - peer-review › Article

A Health-IoT Platform Based on the Integration of Intelligent Packaging, Unobtrusive Bio-Sensor, and Intelligent Medicine Box

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Sensing Systems for Wireless Medicine (MediSense)
Authors: Vena, A., Sydänheimo, L., Tentzeris, M. M., Ukkonen, L.
Number of pages: 11
Pages: 89-99
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: IEEE Sensors Journal
Volume: 15
Issue number: 1
ISSN (Print): 1530-437X
Ratings:
Scopus rating (2016): CiteScore 3.12 SJR 0.706 SNIP 1.689
Scopus rating (2015): SJR 0.684 SNIP 1.908 CiteScore 2.85
Scopus rating (2014): SJR 0.799 SNIP 1.934 CiteScore 2.5
Scopus rating (2013): SJR 0.666 SNIP 1.811 CiteScore 2.6
Scopus rating (2012): SJR 0.602 SNIP 1.445 CiteScore 2.09
Scopus rating (2011): SJR 0.572 SNIP 1.421 CiteScore 2.13
Scopus rating (2010): SJR 0.533 SNIP 1.077
Scopus rating (2009): SJR 0.631 SNIP 1.351
Scopus rating (2008): SJR 0.641 SNIP 1.371
Scopus rating (2007): SJR 0.785 SNIP 1.484
Scopus rating (2006): SJR 0.631 SNIP 1.627
Scopus rating (2005): SJR 0.596 SNIP 1.968
Scopus rating (2004): SJR 0.772 SNIP 1.934
Scopus rating (2003): SJR 0.622 SNIP 2.018
Scopus rating (2002): SJR 0.465 SNIP 2.1
Original language: English
DOIs: 10.1109/JSEN.2014.2336838

Bibliographical note
Contribution: organisation=elt,FACT1=1
Portfolio EDEND: 2014-08-30
Publisher name: Institute of Electrical and Electronics Engineers IEEE
Source: researchoutputwizard
Source-ID: 1717
Research output: Scientific - peer-review › Article

A Health-IoT Platform Based on the Integration of Intelligent Packaging, Unobtrusive Bio-Sensor, and Intelligent Medicine Box

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Augmented Human Activities (AHA)
Authors: Yang, G., Xie, L., Mäntysalo, M., Zhou, X., Pang, Z., Xu, L., Kao-Walter, S., Chen, Q., Zheng, L.
Number of pages: 12
Pages: 2180-2191
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: IEEE Transactions on Industrial Informatics
Volume: 10
Issue number: 4
ISSN (Print): 1551-3203
Ratings:
Scopus rating (2016): CiteScore 3.12 SJR 0.706 SNIP 1.689
Scopus rating (2015): SJR 0.684 SNIP 1.908 CiteScore 2.85
Scopus rating (2014): SJR 0.799 SNIP 1.934 CiteScore 2.5
Scopus rating (2013): SJR 0.666 SNIP 1.811 CiteScore 2.6
Scopus rating (2012): SJR 0.602 SNIP 1.445 CiteScore 2.09
Scopus rating (2011): SJR 0.572 SNIP 1.421 CiteScore 2.13
Scopus rating (2010): SJR 0.533 SNIP 1.077
Scopus rating (2009): SJR 0.631 SNIP 1.351
Scopus rating (2008): SJR 0.641 SNIP 1.371
Scopus rating (2007): SJR 0.785 SNIP 1.484
Scopus rating (2006): SJR 0.631 SNIP 1.627
Scopus rating (2005): SJR 0.596 SNIP 1.968
Scopus rating (2004): SJR 0.772 SNIP 1.934
Scopus rating (2003): SJR 0.622 SNIP 2.018
Scopus rating (2002): SJR 0.465 SNIP 2.1
Original language: English
DOIs: 10.1109/JSEN.2014.2336838

Bibliographical note
Contribution: organisation=elt,FACT1=1
Portfolio EDEND: 2014-08-30
Publisher name: Institute of Electrical and Electronics Engineers IEEE
Source: researchoutputwizard
Source-ID: 1717
Research output: Scientific - peer-review › Article
Alternative sintering methods compared to conventional thermal sintering for inkjet printed silver nanoparticle ink

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Augmented Human Activities (AHA)
Authors: Niittynen, J., Abbel, R., Mäntysalo, M., Perelaer, J., Schubert, U. S., Lupo, D.
Number of pages: 8
Pages: 452-459
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Thin Solid Films
Volume: 556
ISSN (Print): 0040-6090
Ratings:
Scopus rating (2016): SJR 0.64 SNIP 0.897 CiteScore 1.83
Scopus rating (2015): SJR 0.705 SNIP 0.98 CiteScore 1.84
Scopus rating (2014): SJR 0.73 SNIP 1.115 CiteScore 1.94
Scopus rating (2013): SJR 0.818 SNIP 1.215 CiteScore 2
Scopus rating (2012): SJR 0.899 SNIP 1.162 CiteScore 1.86
Scopus rating (2011): SJR 0.995 SNIP 1.337 CiteScore 2.13
Scopus rating (2010): SJR 1.141 SNIP 1.235
Scopus rating (2009): SJR 1.142 SNIP 1.221
Scopus rating (2008): SJR 1.191 SNIP 1.282
Scopus rating (2006): SJR 1.147 SNIP 1.318
Scopus rating (2005): SJR 1.173 SNIP 1.246
Scopus rating (2004): SJR 1.188 SNIP 1.308
Scopus rating (2003): SJR 1.231 SNIP 1.282
Scopus rating (2002): SJR 1.175 SNIP 1.14
Scopus rating (2001): SJR 1.032 SNIP 1.032
Scopus rating (2000): SJR 0.99 SNIP 0.924
Scopus rating (1999): SJR 0.914 SNIP 0.862
Original language: English
Altistaako vai ei - Etäluettavat sähkömittarit kartoitettiin

General information
State: Published
Ministry of Education publication type: D1 Article in a trade journal
Organisations: Department of Electronics and Communications Engineering
Authors: Korpinen, L., Pääkkönen, R.
Number of pages: 4
Pages: 15-18
Publication date: 2014
Peer-reviewed: Unknown

Publication information
Journal: Sähkö & Tele
Volume: 87
Issue number: 4
Original language: Finnish

Bibliographical note
Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2014-06-27<br/>Publisher name: Sähköinsinööriliitto
Source: researchoutputwizard
Source-ID: 779
Research output: Professional › Article

A miniaturized 64-channel 225μW wireless electrocorticographic neural sensor

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Sensing Systems for Wireless Medicine (MediSense)
Authors: Muller, R., Le, H., Li, W., Ledochowitsch, P., Gambini, S., Björminen, T., Koralek, A., Carmena, J. M., Maharbiz, M. M., Alon, E., Rabaey, J. M.
Number of pages: 2
Pages: 412-413
Publication date: 2014

Host publication information
Place of publication: Piscataway, NJ
Publisher: Institute of Electrical and Electronics Engineers IEEE
ISBN (Print): 978-1-4799-0918-6
DOIs: 10.1109/ISSCC.2014.6757492

Bibliographical note
Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2014-04-29<br/>Publisher name: Institute of Electrical and Electronics Engineers IEEE
Source: researchoutputwizard
Source-ID: 1110
Research output: Scientific - peer-review › Conference contribution
Analysis of Biotelemetric Interrogation of Chronically Implantable Intracranial Capacitive Pressure Sensor

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Sensing Systems for Wireless Medicine (MediSense)
Authors: Moradi, E., Björninen, T., Sydänheimo, L., Ukkonen, L.
Number of pages: 5
Pages: 145-149
Publication date: 2014

Host publication information
Title of host publication: 2014 IEEE RFID Technology and Applications Conference, 8-9 September 2014, Tampere, Finland,
Publisher: Institute of Electrical and Electronics Engineers IEEE
DOIs:
10.1109/RFID-TA.2014.6934217

Bibliographical note
Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2014-09-11<br/>Publisher name: Institute of Electrical and Electronics Engineers IEEE
Source: researchoutputwizard
Source-ID: 1104
Research output: Scientific - peer-review › Conference contribution

A New Approach and Analysis of Modeling the Human Body in RFID-Enabled Body-Centric Wireless Systems

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Sensing Systems for Wireless Medicine (MediSense)
Authors: Koski, K., Björninen, T., Sydänheimo, L., Ukkonen, L., Rahmat-Samii, Y.
Number of pages: 12
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: International Journal of Antennas and Propagation
Article number: 368090
ISSN (Print): 1687-5869
Ratings:
Scopus rating (2016): CiteScore 0.94 SJR 0.276 SNIP 0.576
Scopus rating (2015): SJR 0.35 SNIP 0.753 CiteScore 0.97
Scopus rating (2014): SJR 0.36 SNIP 0.695 CiteScore 0.94
Scopus rating (2013): SJR 0.337 SNIP 0.677 CiteScore 1.04
Scopus rating (2012): SJR 0.256 SNIP 0.546 CiteScore 0.85
Scopus rating (2011): SJR 0.133 SNIP 0.14 CiteScore 0.79
Original language: English
DOIs:
10.1155/2014/368090

Bibliographical note
Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2014-05-30<br/>Publisher name: Hindawi Publishing Corporation
Source: researchoutputwizard
Source-ID: 789
Research output: Scientific - peer-review › Article

Anodic Oxidation of Ultra-Thin Ti Layers on ITO Substrates and their Application in Organic Electronic Memory Elements
A Novel Inkjet-Printed Wireless Chipless Strain and Crack Sensor on Flexible Laminates

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Optoelectronics Research Centre, Research group: Surface Science, Augmented Human Activities (AHA), Frontier Photonics
Authors: Heljo, P., Wolff, K., Lahtonen, K., Valden, M., Berger, P., Majumdar, H., Lupo, D.
Number of pages: 8
Pages: 91-98
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Electrochimica Acta
Volume: 137
Issue number: 10
ISSN (Print): 0013-4686
Ratings:
Scopus rating (2016): SJR 1.357 SNIP 1.167 CiteScore 4.74
Scopus rating (2015): SJR 1.349 SNIP 1.344 CiteScore 4.86
Scopus rating (2014): SJR 1.391 SNIP 1.482 CiteScore 4.59
Scopus rating (2013): SJR 1.435 SNIP 1.607 CiteScore 4.44
Scopus rating (2012): SJR 1.651 SNIP 1.592 CiteScore 3.99
Scopus rating (2011): SJR 1.621 SNIP 1.803 CiteScore 4.15
Scopus rating (2010): SJR 1.691 SNIP 1.725
Scopus rating (2009): SJR 1.536 SNIP 1.625
Scopus rating (2008): SJR 1.533 SNIP 1.47
Scopus rating (2007): SJR 1.563 SNIP 1.595
Scopus rating (2006): SJR 1.534 SNIP 1.736
Scopus rating (2005): SJR 1.481 SNIP 1.533
Scopus rating (2004): SJR 1.365 SNIP 1.581
Scopus rating (2003): SJR 1.628 SNIP 1.526
Scopus rating (2002): SJR 1.644 SNIP 1.459
Scopus rating (2001): SJR 1.319 SNIP 1.408
Scopus rating (2000): SJR 1.009 SNIP 1.168
Scopus rating (1999): SJR 0.989 SNIP 1.192
Original language: English
DOIs:
10.1016/j.electacta.2014.05.157

Bibliographical note
Contribution: organisation=elt,FACT1=0.8<br/>Contribution: organisation=orc,FACT2=0.2<br/>Portfolio EDEND: 2014-09-09<br/>Publisher name: Pergamon Press
Source: researchoutputwizard
Source-ID: 457
Research output: Scientific - peer-review › Article

A Novel Inkjet-Printed Wireless Chipless Strain and Crack Sensor on Flexible Laminates

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Sensing Systems for Wireless Medicine (MediSense)
Authors: Vena, A., Tedjini, M., Björninen, T., Sydänheimo, L., Ukkonen, L., Tentzeris, M. M.
Number of pages: 2
Pages: 1294-1295
Publication date: 2014

Host publication information
Title of host publication: 2014 IEEE Antennas and Propagation Society International Symposium (APSURSI), 6-11 July 2014, Memphis, TN, USA
A novel RFID-enabled strain sensor using the double power measurement technique

Antennas for Small Metal Mountable Passive UHF RFID Tags: Challenges and Advances

Design of antennas for metal mountable radio-frequency identification tags is driven by a unique set of challenges: cheap, small, low-profile and conformal structures need to provide reliable operation when tags are mounted on conductive platforms of various shapes and sizes. During the past decade, tremendous amount of research has been dedicated to meet these stringent requirements. Currently, the tag read ranges of several meters are achieved with flexible label type tags. Moreover, a whole spectrum of tag size-performance ratios has been demonstrated through a variety of innovative antenna design approaches. This article reviews and summarizes the progress made in antennas for metal mountable tags and presents future prospects.

Full text is openly accessible at: http://e-fermat.org/files/articles/1537fc0291abc0.pdf
Applicability of macro sensor network in disaster scenarios

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Research group: Laboratory of Radio Network Planning, Wireless Communications and Positioning (WICO)
Authors: Paudel, D., Säe, J., Lempiäinen, J.
Number of pages: 5
Pages: 1-5
Publication date: 2014

Host publication information
Publisher: Institute of Electrical and Electronics Engineers IEEE
ISBN (Print): 978-1-4799-4626-6
DOIs: 10.1109/VITAE.2014.6934480

A Review on Device-Free Passive Indoor Positioning Methods

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Augmented Human Activities (AHA)
Authors: Kivimäki, T., Vuorela, T., Peltola, P., Vanhala, J.
Number of pages: 24
Pages: 71-94
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: International Journal of Smart Home
Volume: 8
Issue number: 1
ISSN (Print): 1975-4094
Ratings:
Scopus rating (2016): SJR 0.199 SNIP 0.574
Scopus rating (2015): SJR 0.2 SNIP 0.985 CiteScore 0.61
Scopus rating (2014): SJR 0.212 SNIP 0.995 CiteScore 0.69
Scopus rating (2013): SJR 0.19 SNIP 1.582 CiteScore 0.91
Scopus rating (2012): SJR 0.195 SNIP 0.829 CiteScore 0.48
Scopus rating (2011): SJR 0.233 SNIP 0.735 CiteScore 0.43
Scopus rating (2010): SJR 0.218 SNIP 0.632
Scopus rating (2009): SJR 0.128 SNIP 0.181
Scopus rating (2008): SJR 0.112 SNIP 0.72
A Simplified Method for Calculation of High Voltage Power Substation Electric Fields

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering
Authors: Okun, O., Korpinen, L.
Number of pages: 2
Publication date: 2014

Host publication information
Title of host publication: EHE2014, 5th International Conference on Electromagnetic Fields, Health and Environment, Porto, Portugal, 24th - 26th April, 2014
Publisher: Portuguese Association for the Development of Electrical Engineering
Article number: PS.5
ISBN (Print): 978-8822-28-6

Bibliographical note
Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2014-04-29<br/>Publisher name: Science and Engineering Research Support Society
Source: researchoutputwizard
Source-ID: 732
Research output: Scientific - peer-review › Article

A Versatile Synchronization System for Biomedical Sensor Development

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Augmented Human Activities (AHA)
Authors: Zakrzewski, M., Joutsen, A., Hännikäinen, J., Palovuori, K.
Number of pages: 4
Pages: 951-954
Publication date: 2014

Host publication information
Title of host publication: XIII Mediterranean Conference on Medical and Biological Engineering and Computing 2013, MEDICON 2013, 25-28 September 2013, Seville, Spain
Publisher: Springer
Editor: Roa Romero, L. M.
ISBN (Print): 978-3-319-00845-5
ISBN (Electronic): 978-3-319-00846-2

Publication series
Name: International Federation for Medical and Biological Engineering Proceedings
Volume: 41
ISSN (Print): 1680-0737
ISSN (Electronic): 1433-9277
DOIs: 10.1007/978-3-319-00846-2_235

Bibliographical note
Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2014-02-15<br/>Publisher name: Springer
Source: researchoutputwizard
Bidirectional Touch Interaction for Immaterial Displays

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Augmented Human Activities (AHA)
Authors: Palovuori, K., Rakkolainen, I., Sand, A.
Number of pages: 2
Pages: 76-78
Publication date: 2014

Host publication information
Title of host publication: Proceedings of the 18th Academic MindTrek Conference 2014: "Media Business, Management, Content & Services", 4-6 November, 2014, Tampere, Finland
Place of publication: New York, NY
Publisher: The Association for Computing Machinery, ACM
Editors: Lugmayr, A., Franssila, H., Paavilainen, J.
ISBN (Print): 978-1-4503-3006-0

Bibliographical note
Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2014-11-30<br/>Publisher name: The Association for Computing Machinery, ACM
Source: researchoutputwizard
Source-ID: 1224
Research output: Scientific - peer-review › Conference contribution

Brush-painted Silver Nanoparticle UHF RFID Tags on Fabric Substrates

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Sensing Systems for Wireless Medicine (MediSense)
Authors: Virkki, J., Björninen, T., Sydänheimo, L., Ukkonen, L.
Number of pages: 5
Pages: 2106-2110
Publication date: 2014

Host publication information
Publisher: The Electromagnetics Academy
ISBN (Print): 978-1-934142-28-8
Links:
http://piers.org/piersproceedings/download.php?file=cGllcnMyMDE0R3Vhbmd6aG91fDNQXzExYl8yMTA2LnBkZnwxDNDzMTgwNTUzMDE=

Bibliographical note
Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2014-10-08<br/>Publisher name: The Electromagnetics Academy
Source: researchoutputwizard
Source-ID: 1749
Research output: Scientific - peer-review › Conference contribution

Cardiac pacemakers and electromagnetic fields: comparison of experimental results in France and Finland

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering
Authors: Magne, I., Korpinen, L., Souques, M.
Characterization of Graphene-Based Inkjet Printed Samples on Flexible Substrate for Wireless Sensing Applications

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Department of Materials Science, Engineering materials science and solutions (EMASS), Sensing Systems for Wireless Medicine (MediSense)
Authors: Akbari, M., Sydänheimo, L., Juutl, J., Vuorinen, J., Ukkonen, L.
Number of pages: 5
Pages: 135-139
Publication date: 2014

Host publication information
Title of host publication: 2014 IEEE RFID Technology and Applications Conference, 8-9 September 2014, Tampere, Finland
Publisher: Institute of Electrical and Electronics Engineers IEEE
DOIs:
10.1109/RFID-TA.2014.6934215

Bibliographical note
Contribution: organisation=elt,FACT1=1
Portfolio EDEND: 2014-10-19
Publisher name: Institute of Electrical and Electronics Engineers IEEE
Source-ID: 75
Research output: Scientific - peer-review › Conference contribution

Characterization of Laser Sintering of Copper Nanoparticle Ink by FEM and Experimental Testing

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Augmented Human Activities (AHA)
Authors: Niittynen, J., Mäntysalo, M.
Number of pages: 8
Pages: 2018-2025
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: IEEE Transactions on Components, Packaging and Manufacturing Technology
Volume: 4
Issue number: 12
ISSN (Print): 2156-3950
Ratings:
Comparison of electric field exposure measurement methods under power lines

**General information**
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering
Authors: Korpinen, L., Kuisti, H., Tarao, H., Pääkkönen, R., Elovaara, J.
Number of pages: 3
Pages: 221-223
Publication date: 2014
Peer-reviewed: Yes

**Publication information**
Journal: Radiation Protection Dosimetry
Volume: 158
Issue number: 2
ISSN (Print): 0144-8420
Ratings:
Scopus rating (2016): SJR 0.444 SNIP 0.727 CiteScore 0.86
Scopus rating (2015): SJR 0.466 SNIP 0.832 CiteScore 0.82
Scopus rating (2014): SJR 0.517 SNIP 0.913 CiteScore 0.89
Scopus rating (2013): SJR 0.538 SNIP 0.815 CiteScore 0.9
Scopus rating (2012): SJR 0.556 SNIP 0.801 CiteScore 0.82
Scopus rating (2011): SJR 0.541 SNIP 1.049 CiteScore 0.96
Scopus rating (2010): SJR 0.574 SNIP 0.802
Scopus rating (2009): SJR 0.475 SNIP 0.75
Scopus rating (2008): SJR 0.586 SNIP 1.022
Scopus rating (2007): SJR 0.483 SNIP 1.011
Scopus rating (2006): SJR 0.372 SNIP 0.705
Scopus rating (2005): SJR 0.401 SNIP 0.723
Scopus rating (2004): SJR 0.428 SNIP 0.842
Scopus rating (2003): SJR 0.341 SNIP 0.523
Scopus rating (2002): SJR 0.45 SNIP 0.834
Scopus rating (2001): SJR 0.476 SNIP 0.899
Scopus rating (2000): SJR 0.464 SNIP 0.748
Scopus rating (1999): SJR 0.465 SNIP 0.929
Original language: English
DOIs:
10.1093/rpd/nct201

**Bibliographical note**
Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2014-11-24<br/>Publisher name: Institute of Electrical and Electronics Engineers IEEE
Source: researchoutputwizard
Source-ID: 1143
Research output: Scientific - peer-review › Article
Comparison of inkjet-printed and microfabricated loop antennas for implants in wireless brain-machine interface systems

We analyze the performance of an inductive link between a cm-size loop antenna based on conventional circuit board fabrication and 6.5×6.5 mm² planar loop antennas deposited on flexible platforms by inkjet printing gold nanoparticle ink and by electron-beam evaporation. The highly flexible antennas have been designed to provide wireless power and data telemetry for battery-free cortical implants in wireless brain-machine interface systems. The performance of the wireless link is analyzed through full-wave electromagnetic simulations in an anatomical head model and through measurements in a liquid head phantom.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Sensing Systems for Wireless Medicine (MediSense)
Authors: Moradi, E., Björninen, T., Sydänheimo, L., Ukkonen, L.
Number of pages: 3
Pages: 80-82
Publication date: 2014

Host publication information
Title of host publication: IEEE International Microwave Workshop Series on RF and Wireless Technologies for Biomedical and Healthcare Applications, 8-10 December, 2014, London, UK
Publisher: Institute of Electrical and Electronics Engineers IEEE
ISBN (Print): 978-1-4799-5447-6
DOIs: 10.1109/IMWS-BIO.2014.7032415

Bibliographical note
Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2014-12-15<br/>Publisher name: Institute of Electrical and Electronics Engineers IEEE
Source: researchoutputwizard
Source-ID: 1105
Research output: Scientific - peer-review › Conference contribution

Comparison of methods to define power line and substation's busbar wire capacitances in electric field calculation task

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering
Authors: Okun, O., Korpinen, L.
Number of pages: 6
Pages: 79-85
Publication date: 2014

Host publication information
Title of host publication: 8th International Workshop on Biological Effects of Electromagnetic Fields, 21-26 September, 2014, Golden Sands, Varna, Bulgaria
Links:

Bibliographical note
Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2014-11-15
Source: researchoutputwizard
Source-ID: 1191
Research output: Scientific - peer-review › Conference contribution

Compression stockings with integrated ICT for customized performance

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Department of Materials Science
Context Recognition in a Smart Home: Living Experiment

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Research group: Personal Electronics Group, Augmented Human Activities (AHA)
Authors: Vainio, A., Pensas, H., Vanhala, J.
Number of pages: 4
Pages: 167-170
Publication date: 2014

Host publication information
Title of host publication: Proceedings of the 18th International Academic MindTrek Conference: Media Business, Management, Content Services
Place of publication: New York, NY, USA
Publisher: ACM
ISBN (Print): 978-1-4503-3006-0
Keywords: activities of daily living, context recognition, living experiment
DOIs: 10.1145/2676467.2676479
Source: Bibtex
Source-ID: urn:699d5c526510148c709c83401b637994
Research output: Scientific - peer-review → Conference contribution

Co-operation between Industry, Authorities and Research Institutes in Environmental and Occupational Exposure to Electric and Magnetic Field Questions in Finland

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering
Authors: Pääkkönen, R., Korpinen, L.
Number of pages: 2
Publication date: 2014

Host publication information
Title of host publication: EHE2014, 5th International Conference on Electromagnetic Fields, Health and Environment, Porto, Portugal, 24th - 26th April, 2014
Publisher: Portuguese Association for the Development of Electrical Engineering
Article number: PS, 23
ISBN (Print): 978-972-8822-28-6
Current densities and total contact currents for 110 and 220 kV power line tasks

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering
Authors: Korpinen, L., Kuisti, H., Elovaara, J.
Number of pages: 5
Pages: 531-535
Publication date: 2014
Peer-reviewed: Yes

Publication Information
Journal: Bioelectromagnetics
Volume: 35
Issue number: 7
ISSN (Print): 0197-8462
Ratings:
Scopus rating (2016): SJR 0.572 SNIP 1.1 CiteScore 1.99
Scopus rating (2015): SJR 0.599 SNIP 1.079 CiteScore 1.86
Scopus rating (2014): SJR 0.624 SNIP 1.259 CiteScore 1.79
Scopus rating (2013): SJR 0.68 SNIP 1.341 CiteScore 2.13
Scopus rating (2012): SJR 0.623 SNIP 1.15 CiteScore 1.98
Scopus rating (2011): SJR 0.515 SNIP 1.225 CiteScore 2.27
Scopus rating (2010): SJR 0.817 SNIP 1.206
Scopus rating (2009): SJR 0.717 SNIP 1.334
Scopus rating (2008): SJR 0.691 SNIP 0.992
Scopus rating (2007): SJR 0.754 SNIP 1.363
Scopus rating (2006): SJR 0.553 SNIP 1.341
Scopus rating (2005): SJR 0.619 SNIP 1.4
Scopus rating (2004): SJR 0.649 SNIP 1.242
Scopus rating (2003): SJR 0.598 SNIP 0.916
Scopus rating (2002): SJR 0.576 SNIP 1.101
Scopus rating (2001): SJR 0.61 SNIP 1.556
Scopus rating (2000): SJR 0.772 SNIP 1.359
Scopus rating (1999): SJR 0.548 SNIP 1.369
Original language: English
DOIs:
10.1002/bem.21870

Bibliographical note
Contribution: organisation=elt,FACT1=1
Portfolio EDEND: 2014-05-25
Publisher name: Portuguese Association for the Development of Electrical Engineering
Source: researchoutputwizard
Source-ID: 1207
Research output: Scientific - peer-review › Conference contribution

Design and Optimization of mm-Size Implantable and Wearable On-Body Antennas for Biomedical Systems

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Sensing Systems for Wireless Medicine (MediSense)
Dual port temperature sensor tag for passive UHF RFID systems

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Sensing Systems for Wireless Medicine (MediSense)
Authors: Virtanen, J., Yang, F., Ukkonen, L., Elsherbeni, A., Babar, A., Sydänheimo, L.
Number of pages: 16
Pages: 154-169
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Sensor Review
Volume: 34
Issue number: 2
ISSN (Print): 0260-2288
Ratings:
Scopus rating (2016): SJR 0.352 SNIP 0.873
Scopus rating (2015): SJR 0.245 SNIP 0.711
Scopus rating (2014): SJR 0.199 SNIP 0.731
Scopus rating (2013): SJR 0.176 SNIP 0.681
Scopus rating (2012): SJR 0.221 SNIP 0.617
Scopus rating (2011): SJR 0.167 SNIP 0.692
Scopus rating (2010): SJR 0.156 SNIP 0.526
Scopus rating (2009): SJR 0.174 SNIP 0.649
Scopus rating (2008): SJR 0.134 SNIP 0.657
Scopus rating (2007): SJR 0.171 SNIP 0.51
Scopus rating (2006): SJR 0.158 SNIP 0.533
Scopus rating (2005): SJR 0.206 SNIP 0.598
Scopus rating (2004): SJR 0.126 SNIP 0.466
Scopus rating (2003): SJR 0.106 SNIP 0.363
Scopus rating (2002): SJR 0.121 SNIP 0.742
Scopus rating (2001): SJR 0.12 SNIP 0.436
Scopus rating (2000): SJR 0.234 SNIP 0.488
Scopus rating (1999): SJR 0.106 SNIP 0.08
Original language: English
DOIs:
10.1108/SR-12-2011-681
Effect of Sintering Method on the Read Range of Brush-painted Silver Nanoparticle UHF RFID Tags on Wood and Polyimide Substrates

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Sensing Systems for Wireless Medicine (MediSense)
Authors: Sipilä, E., Virkki, J., Sydänheimo, L., Ukkonen, L.
Number of pages: 4
Pages: 219-222
Publication date: 2014

Host publication information
Title of host publication: 2014 IEEE RFID Technology and Applications Conference, 8-9 September, 2014, Tampere, Finland
DOIs: 10.1109/RFID-TA.2014.6934231

Electrostatic Threats in Hospital Environment
Uncontrolled electrostatic discharge (ESD) sources may cause unpleasant experiences as well as more serious hazards to health. We have observed surprisingly high energy ESD sources in the hospital environment. These findings are analyzed and discussed in this article. In addition, electrostatic attraction and charge relaxation of materials for medical purposes are studied and solutions are proposed.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Cascade Metrol, Kanta Hame Cent Hosp, Premix Oy, Ion Phase E, Electrostat Solut Ltd
Authors: Viheriäkoski, T., Kokkonen, M., Tamminen, P., Karja, E., Hillberg, J., Smallwood, J.
Number of pages: 9
Publication date: 2014

Host publication information
Title of host publication: 2014 36TH Electrical overstress/electrostatic discharge symposium (EOS/ESD)
Publisher: IEEE COMPUTER SOC

Publication series
Name: Electrical Overstress Electrostatic Discharge Symposium
Publisher: IEEE COMPUTER SOC
ISSN (Print): 0739-5159
Source: WOS
Source-ID: 000355792800054
Research output: Scientific - peer-review › Conference contribution

Electro-Textile UHF RFID Patch Antennas for Positioning and Localization Applications

General information
State: Published
ESD Sensitivity of 01005 Chip Resistors and Capacitors

Miniaturization of passive surface mount components has decreased the package size down to 01005. These tiny components are ESD sensitive and can get ESD damages on a system board. In this paper ESD sensitivities of 01005 chip resistors and capacitors are studied on a system board.

Example measurements of exposure to ELF magnetic fields on the metro station in Finland

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Sensing Systems for Wireless Medicine (MediSense)
Authors: Koski, K., Lohan, E. S., Sydänheimo, L., Ukkonen, L., Rahmat-Samii, Y.
Number of pages: 5
Pages: 246-250
Publication date: 2014

Host publication information
Title of host publication: 2014 IEEE RFID Technology and Applications Conference, 8-9 September 2014, Tampere, Finland
Publisher: Institute of Electrical and Electronics Engineers IEEE
DOIs: 10.1109/RFID-TA.2014.6934237

Bibliographical note
Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2014-10-15<br/>Publisher name: Institute of Electrical and Electronics Engineers IEEE
Source: researchoutputwizard
Source-ID: 790
Research output: Scientific - peer-review › Conference contribution

ESD Sensitivity of 01005 Chip Resistors and Capacitors

Miniaturization of passive surface mount components has decreased the package size down to 01005. These tiny components are ESD sensitive and can get ESD damages on a system board. In this paper ESD sensitivities of 01005 chip resistors and capacitors are studied on a system board.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Authors: Tamminen, P., Sydänheimo, L., Ukkonen, L.
Number of pages: 9
Publication date: 2014

Host publication information
Title of host publication: 2014 36TH Electrical Overstress/Electrostatic Discharge Symposium (EOS/ESD)
Publisher: IEEE COMPUTER SOC
Publication series
Name: Electrical Overstress Electrostatic Discharge Symposium
Publisher: IEEE COMPUTER SOC
ISSN (Print): 0739-5159
Source-ID: 000355792800042
Research output: Scientific - peer-review › Conference contribution

Example measurements of exposure to ELF magnetic fields on the metro station in Finland

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering
Authors: Korpinen, L., Lähdetie, A., Amundin, Å., Piippo, H., Sydänheimo, L.
Number of pages: 4
Pages: 338-341
Publication date: 2014

Host publication information
Title of host publication: 8th International Workshop on Biological Effects of Electromagnetic Fields, 21-26 September, 2014, Golden Sands, Varna, Bulgaria
Links:
Examples of the Teaching of the Health Issues of Electromagnetic Fields at Tampere University of Technology in Finland

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering
Authors: Korpinen, L., Pääkkönen, R.
Number of pages: 2
Publication date: 2014

Host publication information
Title of host publication: EHE2014, 5th International Conference on Electromagnetic Fields, Health and Environment, Porto, Portugal, 24th - 26th April, 2014
Publisher: Portuguese Association for the Development of Electrical Engineering
Article number: PS.20

Bibliographical note
Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2014-05-25<br/>Publisher name: Portuguese Association for the Development of Electrical Engineering
Source: researchoutputwizard
Source-ID: 770
Research output: Scientific - peer-review › Conference contribution

Examples se desures de l'exposition aux champs magnétiques ELF dans une station de métro en Finlannde

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering
Authors: Korpinen, L., Lähdetie, A., Amundin, Å., Piippo, H., Sydänheimo, L.
Number of pages: 2
Pages: 1-2
Publication date: 2014

Host publication information
Title of host publication: Effets biologiques et sanitaires des rayonnements non ionisants, Limoges, 16 octobre 2014
Publisher: SFRP

Bibliographical note
Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2014-11-19<br/>Publisher name: SFRP
Source: researchoutputwizard
Source-ID: 778
Research output: Scientific - peer-review › Conference contribution

Experimental Study on Brush-Painted Metallic Nanoparticle UHF RFID Tags on Wood Substrates
Due to an increasing interest to add functionality in various products, versatile electronics manufacturing methods are needed for numerous applications. In this letter, ultra-high-frequency (UHF) radio frequency identification (RFID) tag antennas manufactured by brush-painting directly on wood veneer substrate were examined. Silver and copper nanoparticle inks were used in antenna manufacturing. According to our measurements, brush-painted silver and copper nanoparticle UHF RFID tags showed read ranges of 5 and 3 m, respectively, even when embedded inside wood layers. These read ranges are sufficient for many applications, e.g., in construction and packaging industry, where wood is a common material. The novel manufacturing process, its applications, and the achieved tag performance results are presented in this letter.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Sensing Systems for Wireless Medicine (MediSense)
Authors: Sipilä, E., Virkki, J., Sydänheimo, L., Ukkonen, L.
Number of pages: 4
Pages: 301-304
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: IEEE Antennas and Wireless Propagation Letters
Volume: 14
ISSN (Print): 1536-1225
Ratings:
Scopus rating (2016): SJR 1.257 SNIP 1.803 CiteScore 3.57
Scopus rating (2015): SJR 1.572 SNIP 1.925 CiteScore 2.9
Scopus rating (2014): SJR 1.517 SNIP 1.927 CiteScore 2.79
Scopus rating (2013): SJR 1.202 SNIP 1.703 CiteScore 2.82
Scopus rating (2012): SJR 1.005 SNIP 1.517 CiteScore 2.71
Scopus rating (2011): SJR 0.926 SNIP 1.54 CiteScore 2.32
Scopus rating (2010): SJR 0.736 SNIP 1.25
Scopus rating (2009): SJR 1.083 SNIP 1.582
Scopus rating (2008): SJR 0.794 SNIP 1.256
Scopus rating (2007): SJR 1.421 SNIP 2.221
Scopus rating (2006): SJR 1.599 SNIP 1.911
Scopus rating (2005): SJR 1.943 SNIP 1.839
Scopus rating (2004): SJR 1.411 SNIP 1.972
Scopus rating (2003): SJR 0.918 SNIP 1.391
Original language: English
DOIs:
10.1109/LAWP.2014.2362966

Bibliographical note
Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2014-10-30<br/>Publisher name: Institute of Electrical and Electronics Engineers IEEE
Source: researchoutputwizard
Source-ID: 1516
Research output: Scientific - peer-review > Article

Experimental Study on the Washing Durability of Electro-Textile UHF RFID Tags

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Sensing Systems for Wireless Medicine (MediSense)
Authors: Fu, Y. Y., Chan, Y. L., Yang, M. H., Chan, Y., Virkki, J., Björninen, T., Sydänheimo, L., Ukkonen, L.
Number of pages: 4
Pages: 466-469
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: IEEE Antennas and Wireless Propagation Letters
Volume: 14
ISSN (Print): 1536-1225
Ratings:
Scopus rating (2016): SJR 1.257 SNIP 1.803 CiteScore 3.57
Scopus rating (2015): SJR 1.572 SNIP 1.925 CiteScore 2.9
Scopus rating (2014): SJR 1.517 SNIP 1.927 CiteScore 2.79
Scopus rating (2013): SJR 1.202 SNIP 1.703 CiteScore 2.82
Scopus rating (2012): SJR 1.005 SNIP 1.517 CiteScore 2.71
Exposure to EMF and health issues

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering
Authors: Gobba, F., Korpinen, L.
Number of pages: 2
Publication date: 2014

Host publication information
Place of publication: Paris
Publisher: International Commission on Occupational Health - ICOH, Commission Internationale de la Sante au Travail - CIST

Bibliographical note
Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2014-11-11<br/>Publisher name: Institute of Electrical and Electronics Engineers IEEE
Source: researchoutputwizard
Source-ID: 322
Research output: Scientific - peer-review › Article

Exposure to RF fields during the remote readings of the smart meter in Finland

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering
Authors: Pääkkönen, R., Lundström, M., Mustaparta, J., Korpinen, L.
Number of pages: 2
Pages: 94-96
Publication date: 2014

Host publication information
Title of host publication: 8th International Workshop on Biological Effects of Electromagnetic Fields, 21-26 September, 2014, Golden Sands, Varna, Bulgaria
Links:
Fabrication and characterization of solution-processed carbon nanotube supercapacitors

We report the fabrication and characterization of supercapacitors prepared on a flexible substrate using a printable, high-viscosity carbon nanotube (CNT) ink. The CNT-hemicellulose composite ink was prepared using ultrasonication and applied on the substrate with a doctor blade. Aqueous sodium chloride was used as electrolyte. The capacitance of the supercapacitors was 16 mF for a device size of 2 cm². The measurements were carried out in accordance to an international standard for electric double layer capacitors.

Field Collapse Event ESD Test Method

A novel field collapse event ESD test method is presented in this paper. The device under test is continuously grounded in an electrostatic field and when the field is removed it drives current through the device. We show with measurements and simulations how to use this method to test ESD immunity of electronic products.
High Throughput Electrochemical Method for Contact Optimization in Printed Rectifying Diodes

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering
Authors: Heljo, P. S., Majumdar, H. S., Lupo, D.
Publication date: 2014

Impact of antenna-fiber alignment and recurrent stretching on the performance of passive UHF RFID tags based on textile antennas

Electrically conductive textiles are an enabling technology for the future wearable healthcare. In this work, we investigate the impact of antenna-fiber alignment and recurrent stretching on the performance of passive UHF RFID tags based on screen printed and conductive-fabric antennas. Our results show that on the non-uniform fibrous textiles, the antenna-fiber alignment is an important factor for the performance of the tag and its response to repeated stretching. Moreover, the tags fabricated with the two different methods were found to exhibit contrasting features in their response to the stretching.
Implantable Cardioverter Defibrillators in Magnetic Fields of a 400 kV Substation

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Research group: Environmental Health
Authors: Korpinen, L., Kuisti, H., Tarao, H., Elovaara, J., Virtanen, V.
Number of pages: 9
Pages: 205-213
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Progress In Electromagnetics Research M
Volume: 40
ISSN (Print): 1937-8726
Ratings:
Scopus rating (2016): SJR 0.2 SNIP 0.456 CiteScore 0.67
Scopus rating (2015): SJR 0.248 SNIP 0.494 CiteScore 0.53
Scopus rating (2014): SJR 0.263 SNIP 0.699 CiteScore 0.69
Scopus rating (2013): SJR 0.363 SNIP 0.882 CiteScore 1.14
Scopus rating (2012): SJR 0.35 SNIP 0.758 CiteScore 1.13
Scopus rating (2011): SJR 0.322 SNIP 0.869 CiteScore 1.11
Scopus rating (2010): SJR 0.26 SNIP 0.691
Original language: English
Links:

Bibliographical note
Siirretään portfolio15
Contribution: organisation=elt,FACT1=1
Portfolio EDEND: 2015-01-19
Source: researchoutputwizard
Source-ID: 775
Research output: Scientific - peer-review » Article

Implants cardiaques et champs électromagnétiques : comparaison de résultats en France et en Finlande

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering
Authors: Magne, I., Souques, M., Korpinen, L.
Number of pages: 2
Pages: 1-2
Publication date: 2014

Host publication information
Title of host publication: Effets biologiques et sanitaires des rayonnements non ionisants, Limoges, 16 octobre 2014
Publisher: SFRP
Inkjet Filling of TSVs with Silver Nanoparticle Ink

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Augmented Human Activities (AHA)
Authors: Khorramdel, B., Mäntysalo, M.
Number of pages: 5
Pages: 1-5
Publication date: 2014

Host publication information
Title of host publication: 2014 Electronics System-Integration Technology Conference (ESTC), 16-18 September 2014, Helsinki, Finland
Publisher: Institute of Electrical and Electronics Engineers IEEE
ISBN (Print): 978-1-4799-4026-4
DOIs: 10.1109/ESTC.2014.6962741

Inkjet-Printed GSM900 Band RF Power Harvester on Paper-Based Substrates

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Sensing Systems for Wireless Medicine (MediSense)
Authors: Saghlatoon, H., Khonsari, Z., Sydänheimo, L., Tentzeris, M. M., Ukkonen, L.
Number of pages: 4
Pages: 13-16
Publication date: 2014

Host publication information
Title of host publication: 2014 IEEE RFID Technology and Applications Conference, 8-9 September 2014, Tampere, Finland.
Publisher: Institute of Electrical and Electronics Engineers IEEE
DOIs: 10.1109/RFID-TA.2014.6934192

Inkjet printed nano-particle Cu process for fabrication of re-distribution layers on silicon wafer

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Department of Mechanical Engineering and Industrial Systems, Augmented Human Activities (AHA)
Authors: Soltani, A., Kumpulainen, T., Mäntysalo, M.
Number of pages: 5
Pages: 1685-1689
Publication date: 2014

Host publication information
Title of host publication: 2014 IEEE 64th Electronic Components and Technology Conference (ECTC), 27-30 May 2014, Orlando, FL
Publisher: Institute of Electrical and Electronics Engineers IEEE
ISBN (Print): 978-1-4799-2407-3
DOIs: 10.1109/ECTC.2014.6897523

Bibliographical note
Contribution: organisation=elt,FACT1=0.9<br/>
Contribution: organisation=mei,FACT2=0.1<br/>
Portfolio EDEND: 2014-10-09<br/>
Publisher name: Institute of Electrical and Electronics Engineers IEEE
Source: researchoutputwizard
Source-ID: 1534
Research output: Scientific - peer-review » Conference contribution

Inkjet printed wireless biosensors on stretchable substrate

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Augmented Human Activities (AHA)
Authors: Sillanpää, H., Halonen, E., Liimatta, T., Mäntysalo, M.
Number of pages: 4
Pages: 322-325
Publication date: 2014

Host publication information
Title of host publication: 2014 International Conference on Electronics Packaging (ICEP), 23-25 April 2014, Toyama, Japan
Publisher: Institute of Electrical and Electronics Engineers IEEE
ISBN (Print): 978-4-904090-10-7
DOIs: 10.1109/ICEP.2014.6826704

Bibliographical note
Contribution: organisation=elt,FACT1=1<br/>
Portfolio EDEND: 2014-06-02<br/>
Publisher name: Institute of Electrical and Electronics Engineers IEEE
Source: researchoutputwizard
Source-ID: 1510
Research output: Scientific - peer-review » Conference contribution

Inkjet printing in manufacturing of stretchable interconnects

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Augmented Human Activities (AHA)
Authors: Liimatta, T., Halonen, E., Sillanpää, H., Niittynen, J., Mäntysalo, M.
Number of pages: 6
Pages: 151-156
Publication date: 2014

Host publication information
Title of host publication: 2014 IEEE 64th Electronic Components and Technology Conference (ECTC), 27-30 May 2014, Orlando, FL
Publisher: Institute of Electrical and Electronics Engineers IEEE
ISBN (Print): 978-1-4799-2407-3
DOIs:
Integration of inkjet and RF SoC technologies to fabricate wireless physiological monitoring system

L’enseignement sur « questions sur la santé et exposition aux champs électromagnétiques » à l’université de technologie de Tampere en Finlande

Measurements of magnetic fields and contact currents produced by domestic induction hobs
Mesures préliminaires des émissions de champ électromagnétique (50-100kHz) d’un compteur intelligent en Finlande

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering
Authors: Pääkkönen, R., Lundström, M., Mustaparta, J., Korpinen, L.
Number of pages: 3
Pages: 1-3
Publication date: 2014

Host publication information
Title of host publication: Effets biologiques et sanitaires des rayonnements non ionisants, Limoges, 16 octobre 2014
Publisher: SFRP

Miniature implantable and wearable on-body antennas: Towards the new era of wireless body-centric systems

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Sensing Systems for Wireless Medicine (MediSense)
Number of pages: 21
Pages: 271-291
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: IEEE Antennas and Propagation Magazine
Volume: 56
Issue number: 1
ISSN (Print): 1045-9243
Ratings:
Scopus rating (2016): CiteScore 1.38 SJR 0.632 SNIP 1.202
Scopus rating (2015): SJR 0.861 SNIP 1.46 CiteScore 1.29
Scopus rating (2014): SJR 0.913 SNIP 1.364 CiteScore 1.26
Scopus rating (2013): SJR 0.625 SNIP 1.288 CiteScore 1.24
Scopus rating (2012): SJR 0.515 SNIP 1.212 CiteScore 1.26
Scopus rating (2011): SJR 0.53 SNIP 1.226 CiteScore 1.28
Scopus rating (2010): SJR 0.411 SNIP 1.14
Modelling of Joule heating based self-alignment method for metal grid line passivation

A Joule heating based self-alignment method for solution-processable insulator structures has been modeled for the passivation of metal grid lines, for example for organic light emitting diodes or photovoltaic cells. To minimize overhang of the passivation layer from line edges, we have studied the Joule heating approach using solution-processable, cross-linkable polymer insulator films. Finite element simulations were performed to investigate the heating of the sample using glass and poly(ethylene terephthalate) (PET) substrates. The sample was at room temperature and the current was selected to induce a temperature of 410 K at the conductor. It was found that the selection of substrate material is crucial for the localization of cross-linking. For a PET substrate, the temperature gradient at the edge of the conductor is approximately twice the gradient for glass. As a result, using a glass substrate demands high selectivity from the polymer cross-linking, thus making PET a more suitable substrate material for our application. A flexible PET substrate is, in addition, compatible with roll-to-roll mass-manufacturing processes.

Occupational and environmental exposure to extremely low frequency-magnetic fields in a large group of workers

**General information**

State: Published  
Ministry of Education publication type: A4 Article in a conference publication  
Organisations: Department of Electronics and Communications Engineering  
Authors: Gobba, F., Rossi, P., Bravo, G., Contessa, G. M., Korpinen, L.  
Number of pages: 3  
Pages: 284-286  
Publication date: 2014

**Host publication information**

Title of host publication: 8th International Workshop on Biological Effects of Electromagnetic Fields, 21-26 September, 2014, Golden Sands, Varna, Bulgaria  
Links:  

**Bibliographical note**

Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2014-11-15  
Source: researchoutputwizard  
Source-ID: 355  
Research output: Scientific - peer-review › Conference contribution

Optimisation of manufacturing parameters for inkjet-printed and photonically sintered metallic nanoparticle UHF RFID tags

**General information**

State: Published  
Ministry of Education publication type: A1 Journal article-refereed  
Organisations: Department of Electronics and Communications Engineering, Sensing Systems for Wireless Medicine (MediSense)  
Authors: Ren, Y., Virkki, J., Sydänheimo, L., Ukkonen, L.  
Number of pages: 2  
Pages: 1504-1505  
Publication date: 2014  
Peer-reviewed: Yes

**Publication information**

Journal: Electronics Letters  
Volume: 50  
Issue number: 21  
ISSN (Print): 0013-5194  
Ratings:  
Scopus rating (2016): SJR 0.442 SNIP 0.882 CiteScore 1.35  
Scopus rating (2015): SJR 0.497 SNIP 1.011 CiteScore 1.31  
Scopus rating (2014): SJR 0.522 SNIP 1.061 CiteScore 1.31  
Scopus rating (2013): SJR 0.59 SNIP 1.155 CiteScore 1.45  
Scopus rating (2012): SJR 0.631 SNIP 1.161 CiteScore 1.45  
Scopus rating (2011): SJR 0.634 SNIP 1.098 CiteScore 1.44  
Scopus rating (2010): SJR 0.637 SNIP 1.011  
Scopus rating (2009): SJR 0.728 SNIP 1.072  
Scopus rating (2008): SJR 0.843 SNIP 0.957  
Scopus rating (2007): SJR 0.924 SNIP 1.169  
Scopus rating (2006): SJR 0.863 SNIP 1.192  
Scopus rating (2005): SJR 1.048 SNIP 1.298  
Scopus rating (2004): SJR 1.156 SNIP 1.354  
Scopus rating (2003): SJR 1.372 SNIP 1.352  
Scopus rating (2002): SJR 1.572 SNIP 1.202  
Scopus rating (2001): SJR 1.591 SNIP 1.042  
Scopus rating (2000): SJR 1.264 SNIP 0.951  
Scopus rating (1999): SJR 1.443 SNIP 1.074  
Original language: English
Optimization of Inkjet Printing of Patch Antennas on Low-Cost Fibrous Substrates

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Sensing Systems for Wireless Medicine (MediSense)
Authors: Saghlatoon, H., Sydänheimo, L., Ukkonen, L., Tentzeris, M.
Number of pages: 4
Pages: 915-918
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: IEEE Antennas and Wireless Propagation Letters
Volume: 13
ISSN (Print): 1536-1225
Ratings:
Scopus rating (2016): SJR 1.257 SNIP 1.803 CiteScore 3.57
Scopus rating (2015): SJR 1.572 SNIP 1.925 CiteScore 2.9
Scopus rating (2014): SJR 1.517 SNIP 1.927 CiteScore 2.79
Scopus rating (2013): SJR 1.202 SNIP 1.703 CiteScore 2.82
Scopus rating (2012): SJR 1.005 SNIP 1.517 CiteScore 2.71
Scopus rating (2011): SJR 0.926 SNIP 1.54 CiteScore 2.32
Scopus rating (2010): SJR 0.736 SNIP 1.25
Scopus rating (2009): SJR 1.083 SNIP 1.582
Scopus rating (2008): SJR 0.794 SNIP 1.256
Scopus rating (2007): SJR 1.421 SNIP 2.221
Scopus rating (2006): SJR 1.599 SNIP 1.911
Scopus rating (2005): SJR 1.943 SNIP 1.839
Scopus rating (2004): SJR 1.411 SNIP 1.972
Scopus rating (2003): SJR 0.918 SNIP 1.391
Original language: English
DOIs:
10.1109/LAWP.2014.2322572

Optimization of large-area OLED current distribution grids with self-aligned passivation

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Department of Physics, Department of Mathematics, Augmented Human Activities (AHA), Mathematical modelling with wide societal impact (MathImpact)
Authors: Janka, M., Saukko, E., Raumonen, P., Lupo, D.
Optimized RF/microwave antennas and circuits on low-cost fibrous substrates using inkjet-printing technology

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Sensing Systems for Wireless Medicine (MediSense)
Authors: Saghlatoon, H., Sydänheimo, L., Ukkonen, L., Tentzeris, M. M.
Number of pages: 2
Pages: 322-323
Publication date: 2014

Host publication information
Title of host publication: 2014 IEEE Antennas and Propagation Society International Symposium (APSURSI), 6-11 July 2014, Memphis, TN, USA
Publisher: Institute of Electrical and Electronics Engineers IEEE
ISBN (Print): 978-1-4799-3538-3
ISBN (Electronic): 978-1-4799-3540-6
DOIs: 10.1109/APS.2014.6904493

Bibliographical note
Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2014-09-30<br/>Publisher name: Institute of Electrical and Electronics Engineers IEEE
Optimizing investment in ESD control
We examine strategies for optimizing investment in ESD protection and trade-offs that can arise. Standard ESD measures require low expertise but may result in unnecessary equipment spend. Tailored EPAs may require higher expertise and greater training. ESD control measures and equipment used with inadequate understanding can fail to yield the potential benefits expected. Optimal ESD control results from understanding ESD threats and control, with effective implementation.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Electrostat Solut Ltd, Cascade Metrol
Authors: Smallwood, J., Tamminen, P., Viheriäkoski, T.
Number of pages: 6
Publication date: 2014

Host publication information
Title of host publication: 2014 Electrical Overstress/Electrostatic Discharge Symposium (EOS/ESD)
Publisher: IEEE COMPUTER SOC

Publication series
Name: Electrical Overstress Electrostatic Discharge Symposium
Publisher: IEEE COMPUTER SOC
ISSN (Print): 0739-5159
Source: WOS
Source-ID: 000355792800025
Research output: Scientific - peer-review › Conference contribution

Organic Rectifying Diode and Circuit for Wireless Power Harvesting at 13.56 MHz

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Augmented Human Activities (AHA)
Authors: Li, M., Heljo, P. S., Lupo, D.
Number of pages: 6
Pages: 2164-2169
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: IEEE Transactions on Electron Devices
Volume: 61
Issue number: 6
ISSN (Print): 0018-9383
Ratings:
Scopus rating (2016): SJR 1.022 SNIP 1.735 CiteScore 2.85
Scopus rating (2015): SJR 1.328 SNIP 1.791 CiteScore 2.97
Scopus rating (2014): SJR 1.376 SNIP 1.772 CiteScore 3.06
Scopus rating (2013): SJR 1.411 SNIP 1.801 CiteScore 2.84
Scopus rating (2012): SJR 1.33 SNIP 1.808 CiteScore 2.66
Scopus rating (2011): SJR 1.688 SNIP 2.146 CiteScore 3.16
Scopus rating (2010): SJR 1.673 SNIP 1.73
Scopus rating (2009): SJR 1.875 SNIP 1.923
Scopus rating (2008): SJR 1.922 SNIP 1.974
Scopus rating (2007): SJR 1.952 SNIP 2.096
Scopus rating (2006): SJR 1.839 SNIP 2.183
Scopus rating (2005): SJR 1.792 SNIP 2.21
Scopus rating (2004): SJR 2.151 SNIP 2.206
Path-Loss Model of Embroidered Passive RFID Tag on Human Body for Indoor Positioning Applications

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Sensing Systems for Wireless Medicine (MediSense), Wireless Communications and Positioning (WICO)
Authors: Hasani, M., Lohan, E., Sydänheimo, L., Ukkonen, L.
Number of pages: 5
Pages: 170-174
Publication date: 2014

Host publication information
Title of host publication: 2014 IEEE RFID Technology and Applications Conference, 8-9 September, 2014, Tampere, Finland
Publisher: Institute of Electrical and Electronics Engineers IEEE
DOIs:
10.1109/RFID-TA.2014.6934222

Bibliographical note
Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2014-10-20<br/>Publisher name: Institute of Electrical and Electronics Engineers IEEE
Source: researchoutputwizard
Source-ID: 417
Research output: Scientific - peer-review › Conference contribution

Possibility to decreasing the 50 Hz electric field exposure with different jackets

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering
Authors: Korpinen, L., Pääkkönen, R.
Number of pages: 4
Pages: 86-89
Publication date: 2014

Host publication information
Title of host publication: 8th International Workshop on Biological Effects of Electromagnetic Fields, 21-26 September, 2014, Golden Sands, Varna, Bulgaria
Links:

Bibliographical note
Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2014-11-15
Source: researchoutputwizard
Possible criteria for health surveillance based on the new directive

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering
Authors: Gobba, F., Korpinen, L.
Number of pages: 2
Publication date: 2014

Host publication information
Place of publication: Paris
Publisher: International Commission on Occupational Health - ICOH, Commission Internationale de la Sante au Travail - CIST

Bibliographical note
Contribution: organisation=elt,FACT1=1
Source: researchoutputwizard
Source-ID: 354
Research output: Scientific - peer-review › Conference contribution

Preliminary measurements of smart meter electromagnetic field (50-100 kHz) emissions in Finland

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering
Authors: Pääkkönen, R., Lundström, M., Mustaparta, J., Korpinen, L.
Number of pages: 4
Pages: 90-93
Publication date: 2014

Host publication information
Title of host publication: 8th International Workshop on Biological Effects of Electromagnetic Fields, 21-26 September, 2014, Golden Sands, Varna, Bulgaria
Links:

Bibliographical note
Contribution: organisation=elt,FACT1=1
Source: researchoutputwizard
Source-ID: 1210
Research output: Scientific - peer-review › Conference contribution

Printable and disposable supercapacitor from nanocellulose and carbon nanotubes

Supercapacitors are promising energy storage devices providing capacitance much higher than conventional capacitors and higher power density and longer cycle life than Li-batteries. We report printable and disposable supercapacitors fabricated from solution-processed carbon nanotube (CNT) composite material as active electrodes and nanocellulose (NC) as a separator. Use of a highly porous and electrically conducting CNT film as electrode materials eliminates the need of current collector. NC is a robust separator material used instead of conventional polymer separator films. Supercapacitor characterization was done with a galvanostatic discharge method according to an industrial standard. The capacitance of 1.8 cm2 devices was 14.9–16.5 mF (7.4–9.1 mF/cm2 or 2.4–2.9 F/g) and equivalent series resistance (ESR) 74–155 Ohms. This type of low-cost energy storage devices fabricated from safe and environmentally friendly materials have obvious applications in autonomous intelligence and disposable low-end products.

General information
Quadrature Channel Calibration with a Pendulum for Accurate Displacement Measurement with CW Doppler Radar

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Augmented Human Activities (AHA)
Authors: Zakrzewski, M., Palovuori, K., Vanhala, J.
Pages: 160-162
Publication date: 2014

Host publication information
Publisher: Institute of Electrical and Electronics Engineers IEEE
ISBN (Print): 978-1-4799-5447-6
DOIs: 10.1109/IMWS-BIO.2014.7032441

Bibliographical note
Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2014-12-30<br/>Publisher name: Institute of Electrical and Electronics Engineers IEEE
Source: researchoutputwizard
Source-ID: 1834
Research output: Scientific - peer-review › Conference contribution

Quadrature Imbalance Compensation With Ellipse-Fitting Methods for Microwave Radar Physiological Sensing

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Augmented Human Activities (AHA)
Authors: Zakrazewski, M., Singh, A., Yavari, E., Gao, X., Boric-Lubecke, O., Vanhala, J., Palovuori, K.
Number of pages: 9
Pages: 1400-1408
Publication date: 2014
Peer-reviewed: Yes
Reliability of Flex-to-Flex Interconnections on Inkjet-Printed PCBs Using Electrically Conductive Adhesives

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Department of Electrical Engineering
Authors: Niittynen, J., Koskinen, S., Mäntysalo, M., Kiilunen, J., Pippola, J., Frisk, L.
Number of pages: 8
Pages: 1-8
Publication date: 2014

Host publication information
Title of host publication: SMTA Pan Pacific Microelectronics Symposium, February 11-13, 2014, Hawaii, USA
Place of publication: Edina, Minnesota
Publisher: Surface Mount Technology Association
ISBN (Print): 978-0-9888873-3-6

Bibliographical note
Contribution: organisation=elt,FACT1=0.5
Contribution: organisation=dee,FACT2=0.5
Portfolio EDEND: 2014-05-08
Publisher name: Surface Mount Technology Association
Source: researchoutputwizard
Source-ID: 1142
Research output: Scientific - peer-review > Conference contribution
Reliability of SMD interconnections on flexible low-temperature substrates with inkjet-printed conductors

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Augmented Human Activities (AHA)
Authors: Putala, J., Hannu, J., Kunnari, E., Mäntysalo, M., Nousiainen, O., Jantunen, H.
Number of pages: 9
Pages: 272-280
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Microelectronics Reliability
Volume: 54
Issue number: 1
ISSN (Print): 0026-2714

Ratings:
Scopus rating (2016): SJR 0.47 SNIP 0.976 CiteScore 1.57
Scopus rating (2015): SJR 0.618 SNIP 1.193 CiteScore 1.81
Scopus rating (2014): SJR 0.601 SNIP 1.432 CiteScore 1.9
Scopus rating (2013): SJR 0.594 SNIP 1.264 CiteScore 1.55
Scopus rating (2012): SJR 0.586 SNIP 1.414 CiteScore 1.6
Scopus rating (2011): SJR 0.621 SNIP 1.382 CiteScore 1.63
Scopus rating (2010): SJR 0.602 SNIP 1.114
Scopus rating (2009): SJR 0.736 SNIP 1.176
Scopus rating (2008): SJR 0.932 SNIP 1.235
Scopus rating (2007): SJR 0.743 SNIP 1.228
Scopus rating (2006): SJR 0.716 SNIP 1.153
Scopus rating (2005): SJR 0.514 SNIP 1.009
Scopus rating (2004): SJR 0.537 SNIP 0.823
Scopus rating (2003): SJR 0.472 SNIP 0.786
Scopus rating (2002): SJR 0.592 SNIP 0.756
Scopus rating (2001): SJR 0.411 SNIP 0.694
Scopus rating (2000): SJR 0.349 SNIP 0.382
Scopus rating (1999): SJR 0.22 SNIP 0.562
Original language: English
DOI:
10.1016/j.microrel.2013.08.021

Bibliographical note
Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2014-02-15<br/>Publisher name: Pergamon
Source: researchoutputwizard
Source-ID: 1311
Research output: Scientific › peer-review › Article

Reliability of washable wearable screen printed UHF RFID tags

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Sensing Systems for Wireless Medicine (MediSense)
Authors: Virkki, J., Björninen, T., Kellomäki, T., Merilampi, S., Shafiq, I., Ukkonen, L., Sydänheimo, L., Chan, Y.
Number of pages: 7
Pages: 840-846
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Microelectronics Reliability
Semi-automatic Measurement of Microfibril Angle on a Microrobotic Platform

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Department of Automation Science and Engineering, Augmented Human Activities (AHA), Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Hirvonen, J., Latifi, S. K., Palovuori, K., Kallio, P.
Number of pages: 4
Pages: 375-378
Publication date: 2014

Host publication information
Title of host publication: Proceedings of the 4th International Conference on Manipulation, Manufacturing and Measurement on the Nanoscale (3M-NANO), 27-31 October 2014, Taipei, Taiwan
Publisher: Institute of Electrical and Electronics Engineers IEEE
ISBN (Print): 978-1-4799-7923-3

Bibliographical note
Contribution: organisation=ase,FACT1=1
Contribution: organisation=elt,FACT2=0
Portfolio EDEND: 2015-01-09
Source: researchoutputwizard
Source-ID: 483
Research output: Scientific - peer-review › Conference contribution

Split ring antennas - A Less Explored Antenna Type in Far Field RFID Tags

General information
State: Published
Spray coating of self-aligning passivation layer for metal grid lines

In applications such as organic light emitting diodes (OLEDs) or photovoltaic cells a homogenous voltage distribution in the large anode layer needs to be ensured by including a metal grid with a transparent conductor layer. To ensure sufficient conductivity, relatively thick metal lines are used, which increases the risk of electrical shorts between the anode and the cathode. For this reason an insulating layer is needed on top of the metal lines. The thick metal lines limit the choice of deposition method, since some methods such as spin coating require smooth surfaces and cannot be used for applying the insulator.

Here, a spray coating process has been studied as a potential alternative deposition method to create thin resistive layers on rough surfaces. Spray coating and Joule heating has been used for the alignment of insulator films on printed metal lines. It was demonstrated that spray coating can be used to cover the printed metal lines which have high peaks on them. The spray coating forms electrically insulating layers even though the film thickness is less than the height of the peaks. The leakage current through the dielectric was on the order of 10^-6 A/cm².
The New Directive 2013/15/EU on Occupational Exposure to Electromagnetic Fields and Electrical Workers' Exposure at 100kV Substations in Finland

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering
Authors: Korpinen, L., Pääkkönen, R.
Number of pages: 2
Publication date: 2014

Host publication information
Title of host publication: EHE2014, 5th International Conference on Electromagnetic Fields, Health and Environment, Porto, Portugal, 24th - 26th April, 2014
Publisher: Portuguese Association for the Development of Electrical Engineering
Article number: PS.19
ISBN (Print): 978-972-8822-28-6

Bibliographical note
Contribution: organisation=elt,FACT1=1
Portfolio EDEND: 2014-05-25
Publisher name: Portuguese Association for the Development of Electrical Engineering
Source: researchoutputwizard
Source-ID: 771
Research output: Scientific - peer-review › Conference contribution

The New Directive 2013/35/EU on Occupational Exposure to Electromagnetic Fields and Electrical Workers’ Use of Implantable Cardioverter Defibrillators (ICDs)

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering
Authors: Korpinen, L., Pääkkönen, R., Souques, M., Virtanen, V.
Number of pages: 5
Pages: 45-49
Publication date: 2014

Host publication information
Title of host publication: Proceedings of 2nd International Congress on Cardiovascular Technologies, CARDIOTECHNIX, Rome, Italy, 25-26 October, 2014
Publisher: SCITEPRESS
ISBN (Print): 978-989-758-055-0
DOIs: 10.5220/0005142500450049

Bibliographical note
Contribution: organisation=elt,FACT1=1
Portfolio EDEND: 2014-11-03
Publisher name: SCITEPRESS
Source: researchoutputwizard
Source-ID: 783
Research output: Scientific - peer-review › Conference contribution

The New Directive 2013/35/EU on Occupational Exposure to Electromagnetic Fields and Electrical Workers’ Use of Cardiac Pacemakers

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering
Authors: Korpinen, L., Pääkkönen, R., Souques, M., Virtanen, V.
Number of pages: 4
Pages: 249-252
Publication date: 2014

Host publication information
Title of host publication: Proceedings of the International Conference on Biomedical Electronics and Devices, BIODEVICES 2014, 3-6 March 2014, Eseo, France
The Use and Know-how of ICT-technology in Different Age Groups

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering
Authors: Korpinen, L., Pääkkönen, R., Gobba, F.
Number of pages: 4
Pages: 56-60
Publication date: 2014

Host publication information
Title of host publication: Proceedings of 2nd International Congress on Neurotechnology, Electronics and Informatics, NEUROTECHNIK, Rome, Italy, 25-26 October, 2014
Publisher: SCITEPRESS
ISBN (Print): 978-989-758-056-7
DOIs:
10.5220/0005142200560060

Bibliographical note
Contribution: organisation=elt,FACT1=1
Portfolio EDEND: 2014-11-03
Publisher name: SCITEPRESS
Source-ID: 781
Research output: Scientific - peer-review › Conference contribution

The Use of Computers in Different Age Groups and their Self-reported Neck Symptoms

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering
Authors: Korpinen, L., Pääkkönen, R., Gobba, F.
Number of pages: 4
Pages: 496-499
Publication date: 2014

Host publication information
Title of host publication: Proceedings of the International Conference on Health Informatics, HEALTHINF 2014, 3-6 March 2014, Eseo, France
Publisher: SCITEPRESS
Article number: 112
ISBN (Print): 978-989-758-010-9
DOIs:
10.5220/0004913104960499

Bibliographical note
Contribution: organisation=elt,FACT1=1
Portfolio EDEND: 2014-04-29
Publisher name: SCITEPRESS
Source-ID: 782
Research output: Scientific - peer-review › Conference contribution
Using Ambient Communication and Social Networking Technologies to Reduce Loneliness of Elders

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Augmented Human Activities (AHA)
Authors: Pensas, H., Vainio, A., Garschall, M., Kivimäki, T., Konakas, S., Costicoglou, S., Vanhala, J.
Number of pages: 12
Pages: 91-102
Publication date: 2014

Host publication information
Publisher: Springer
ISBN (Print): 978-3-319-07631-7
ISBN (Electronic): 978-3-319-07632-4

Publication series
Name: Lecture Notes in Computer Science
Volume: 8531
ISSN (Print): 0302-9743
DOIs: 10.1007/978-3-319-07632-4_9

Bibliographical note
Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2014-08-09<br/>Publisher name: Taylor & Francis
Source: researchoutputwizard
Source-ID: 1174
Research output: Scientific - peer-review › Article

Wireless testing of ink-jet printed mm-size gold implant antennas for brain-machine interfaces

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Sensing Systems for Wireless Medicine (MediSense)
Authors: Moradi, E., Amendola, S., Björninen, T., Sydänheimo, L., Ukkonen, L., Carmena, J. M., Rabaey, J. M.
Number of pages: 2
Pages: 963-964
Publication date: 2014

Host publication information
Title of host publication: 2014 IEEE Antennas and Propagation Society International Symposium (APSURSI), 6-11 July 2014, Memphis, TN, USA

Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2014-06-30<br/>Publisher name: Springer
Source: researchoutputwizard
Source-ID: 1262
Research output: Scientific - peer-review › Conference contribution
WLAN and RFID propagation channels for hybrid indoor positioning

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Sensing Systems for Wireless Medicine (MediSense), Wireless Communications and Positioning (WICO)
Authors: Lohan, E., Koski, K., Talvitie, J., Ukkonen, L.
Number of pages: 6
Pages: 1-6
Publication date: 2014

Host publication information
Title of host publication: 2014 International Conference on Localization and GNSS (ICL-GNSS), 24-26 June 2014, Helsinki, Finland
Publisher: Institute of Electrical and Electronics Engineers IEEE
ISBN (Print): 978-1-4799-5123-9
DOIs: 10.1109/ICL-GNSS.2014.6934184

Bibliographical note
Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2014-08-20<br/>Publisher name: Institute of Electrical and Electronics Engineers IEEE
Source: researchoutputwizard
Source-ID: 965
Research output: Scientific - peer-review › Conference contribution

Workers at particular risk: the case of medical implants

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering
Authors: Korpinen, L., Souques, M.
Number of pages: 2
Publication date: 2014

Host publication information
Place of publication: Paris
Publisher: International Commission on Occupational Health - ICOH, Commission Internationale de la Sante au Travail - CIST

Bibliographical note
Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2014-05-25<br/>Publisher name: International Commission on Occupational Health - ICOH, Commission Internationale de la Sante au Travail - CIST
Source: researchoutputwizard
Source-ID: 785
Research output: Scientific - peer-review › Conference contribution
Arterial pulse waves measured with EMFi and PPG sensors and comparison of the pulse waveform spectral and decomposition analysis in healthy young and elderly subjects

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Automation Science and Engineering, Integrated Technologies for Tissue Engineering (ITTE)
Authors: Huotari, M., Vehkaoja, A., Määttä, K., Röning, J.
Number of pages: 10
Pages: 57-66
Publication date: 2013
Peer-reviewed: Yes

Publication information
Journal: Finnish Journal of eHealth and eWelfare
Volume: 5
Issue number: 2-3
ISSN (Print): 1798-0798
Original language: English
Links:
http://ojs.tsv.fi/index.php/stty

Bibliographical note
Contribution: organisation=ase,FACT1=1<br/>Portfolio EDEND: 2013-10-29<br/>Publisher name: Sosiaali- ja Terveyshuollon Tietojenkäsittely
Source: researchoutputwizard
Source-ID: 2334
Research output: Scientific - peer-review › Article

Capacitive facial activity measurement
A wide range of applications can benefit from the measurement of facial activity. The current study presents a method that can be used to detect and classify the movements of different parts of the face and the expressions the movements form. The method is based on capacitive measurement of facial movements. It uses principal component analysis on the measured data to identify active areas of the face in offline analysis, and hierarchical clustering as a basis for classifying the movements offline and in real-time. Experiments involving a set of voluntary facial movements were carried out with 10 participants. The results show that the principal component analysis of the measured data could be applied with almost perfect performance to offline mapping of the vertical location of the facial activity of movements such as raising and lowering eyebrows, opening mouth, raising mouth corners, and lowering mouth corners. The presented classification method also performed very well in classifying the same movements both with the offline and the real-time implementations.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Automation Science and Engineering
Number of pages: 8
Pages: 78-85
Publication date: 2013
Peer-reviewed: Yes

Publication information
Journal: Acta IMEKO
Volume: 2
Issue number: 2
ISSN (Print): 0237-028X
Ratings:
Scopus rating (2016): SJR 0.205 SNIP 0.564
Scopus rating (2015): SJR 0.124 SNIP 0
Original language: English
Electronic versions:
Capacitive Measurement of Facial Activity Intensity

The measurement of the intensity of facial muscle activity can be used in several applications such as human–computer interaction and behavioural science. A new method for the intensity measurement is presented. It is based on a contactless, capacitive measurement of the movements that the facial activity produces. The muscles responsible for raising the eyebrows, lowering the eyebrows, raising the mouth corners, and pulling down the mouth corners were measured simultaneously with the capacitive method and electromyography (EMG) during controlled experiments. Each muscle was activated by 10 participants at three different intensity levels (low, medium, and high), 10 repetitions at each level. The capacitive intensity values were in good agreement with the ones registered with the EMG: average mean absolute errors were between 7–12% of the observed intensity range. However, compared to the EMG, the capacitive intensity values were noticed to have offsets that may be partly caused by the measurement itself and partly by the EMG reference. As a result, the measurement may require a calibration for more intensity values than just the maximum. In the case of the capacitive method it is also required to distinguish between the muscle activations originating from the same facial regions to determine which activation is taking place. This was done with an almost perfect performance by using hierarchical clustering to cluster the intensity values.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Automation Science and Engineering, Augmented Human Activities (AHA), Field robotics for efficient work sites (FIRE), Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Rantanen, V., Venesvirta, H., Spakov, O., Verho, J., Vetek, A., Surakka, V., Lekkala, J.
Number of pages: 10
Pages: 4329-4338
Publication date: 2013
Peer-reviewed: Yes

Publication information
Journal: IEEE Sensors Journal
Volume: 13
Issue number: 11
ISSN (Print): 1530-437X
Ratings:
Scopus rating (2016): CiteScore 3.12 SJR 0.706 SNIP 1.689
Scopus rating (2015): SJR 0.684 SNIP 1.908 CiteScore 2.85
Scopus rating (2014): SJR 0.799 SNIP 1.934 CiteScore 2.5
Scopus rating (2013): SJR 0.666 SNIP 1.811 CiteScore 2.6
Scopus rating (2012): SJR 0.602 SNIP 1.445 CiteScore 2.09
Scopus rating (2011): SJR 0.572 SNIP 1.421 CiteScore 2.13
Scopus rating (2010): SJR 0.533 SNIP 1.077
Scopus rating (2009): SJR 0.631 SNIP 1.351
Scopus rating (2008): SJR 0.641 SNIP 1.371
Scopus rating (2007): SJR 0.785 SNIP 1.484
Scopus rating (2006): SJR 0.631 SNIP 1.627
Scopus rating (2005): SJR 0.596 SNIP 1.968
Scopus rating (2004): SJR 0.772 SNIP 1.934
Scopus rating (2003): SJR 0.622 SNIP 2.018
Scopus rating (2002): SJR 0.465 SNIP 2.1
Original language: English
Comparison of design measures to reduce 50-Hz magnetic fields of high voltage power objects

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering
Authors: Okun, O., Shevchenko, S., Korpinnen, L.
Number of pages: 7
Pages: 181-187
Publication date: 2013

Host publication information
Title of host publication: 2013 CIGRE, 3rd International Colloquium on Low Frequency Electromagnetic Fields (EMF-ELF 2013), Proceedings, October 15 to 16, 2013, Nara, Japan
Publisher: International Council on Large Electric Systems CIGRE
Article number: A-P-12

Publication series
Name: International Colloquium on Low Frequency Electromagnetic Fields

Current densities and total contact currents associated with 400kV power line tasks

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering
Authors: Korpinnen, L., Kuisti, H., Elovaara, J.
Number of pages: 4
Pages: 641-644
Publication date: 2013
Peer-reviewed: Yes

Publication information
Journal: Bioelectromagnetics
Volume: 34
Issue number: 8
ISSN (Print): 0197-8462
Ratings:
Scopus rating (2016): SJR 0.572 SNIP 1.1 CiteScore 1.99
Scopus rating (2015): SJR 0.599 SNIP 1.079 CiteScore 1.86
Scopus rating (2014): SJR 0.624 SNIP 1.259 CiteScore 1.79
Electromagnetic Modelling and Measurement of Antennas for Wireless Brain-Machine Interface Systems

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Sensing Systems for Wireless Medicine (MediSense)
Authors: Björninen, T., Moradi, E., Sydänheimo, L., Carmena, J. M., Rabaey, J. M., Ukkonen, L.
Number of pages: 3
Pages: 1-3
Publication date: 2013

Host publication information
Title of host publication: IEEE MTT-S International Microwave Workshop Series on RF and Wireless Technologies for Biomedical and Healthcare Applications Digest, IMWS-Bio 2013, December 9-11, 2013, Singapore
Publisher: IEEE
ISBN (Print): 978-1-4673-6095-1

Publication series
Name: IEEE MTT-S International Microwave Workshop on RF and Wireless Technologies for Biomedical and Healthcare Applications
DOI: 10.1109/IMWS-BIO.2013.6756196

Bibliographical note
Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2013-11-29<br/>Publisher name: John Wiley & Sons
Source: researchoutputwizard
Source-ID: 2616
Research output: Scientific - peer-review › Article

Face-hugging device for technology mediated human-human interaction

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Automation Science and Engineering
Face Interface: Using voluntary gaze direction and facial muscle activations for human-computer interaction

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Automation Science and Engineering
Authors: Tuisku, O., Surakka, V., Rantanen, V., Lekkala, J.
Number of pages: 5
Pages: 341-345
Publication date: 2013

Host publication information
Place of publication: Berlin
Publisher: Technische Universität Berlin
Editors: Dittrich, E., Doria, L., Gross, A., Günzler, T., Smiesze, H.

Publication series
Name: Foundations and Applications of Human-Machine Interaction

Bibliographical note
Contribution: organisation=ase,FACT1=1<br/>Portfolio EDEND: 2013-11-29<br/>Publisher name: Technische Universität Berlin
Source: researchoutputwizard
Source-ID: 3669
Research output: Scientific - peer-review › Conference contribution

Improved loop matching techniques and other alternatives to achieve broadband impedance matching in antennas for far field RFID tags

General information
State: Published
Ministry of Education publication type: B1 Article in a scientific magazine
Organisations: Department of Electronics and Communications Engineering
Authors: Björninen, T.
Publication date: 2013
Peer-reviewed: No

Publication information
Journal: IEEE - RFID Virtual Journal
Natural Killer activity in Peripheral Blood Lymphocytes of Workers Exposed to Different Levels of Extremely Low Frequency-Magnetic Fields (ELF-EMF)

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering
Authors: Gobba, F., Korpinen, L., Borella, P., Bargellini, A.
Number of pages: 8
Pages: 205-212
Publication date: 2013

Host publication information
Title of host publication: 2013 CIGRE, 3rd International Colloquium on Low Frequency Electromagnetic Fields (EMF-ELF 2013), Proceedings, October 15 to 16, 2013, Nara, Japan
Publisher: International Council on Large Electric Systems CIGRE
Article number: B-P-03

Publication series
Name: International Colloquium on Low Frequency Electromagnetic Fields

Bibliographical note
Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2013-10-29<br/>Publisher name: International Council on Large Electric Systems CIGRE
Source: researchoutputwizard
Source-ID: 2180
Research output: Scientific › peer-review › Conference contribution
Numerical estimations of induced and contact currents in human body in contact with a car in 60 Hz electric fields

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering
Authors: Tarao, H., Hayashi, N., Korpinen, L., Matsumoto, T., Isaka, K.
Number of pages: 3
Pages: 183-185
Publication date: 2013

Host publication information
Title of host publication: 18th International Symposium on High Voltage Engineering, ISH 2013, in Hanyang University in Seoul, Republic of Korea from August 25 to 30, 2013
Article number: PA-27

Publication series
Name: International Symposium on High Voltage Engineering

Bibliographical note
Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2013-09-29
Source: researchoutputwizard
Source-ID: 3515
Research output: Scientific - peer-review › Conference contribution

Occupational exposure to electric and magnetic fields whilst working around power transformers at 110 kV substations in Tampere, Finland

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering
Authors: Pääkkönen, R., Korpinen, L., Gobba, F.
Number of pages: 4
Pages: 117-120
Publication date: 2013

Host publication information
Title of host publication: 18th International Symposium on High Voltage Engineering, ISH 2013, in Hanyang University in Seoul, Republic of Korea from August 25 to 30, 2013
Article number: PA-13

Publication series
Name: International Symposium on High Voltage Engineering

Bibliographical note
Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2013-09-29
Source: researchoutputwizard
Source-ID: 3074
Research output: Scientific - peer-review › Conference contribution

Pulse waveforms are an indicator of the condition of vascular system

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Automation Science and Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Huotari, M., Vehkaoja, A., Määttä, K., Kostamovaara, J.
Pages: 526-529
Publication date: 2013

Host publication information
Title of host publication: World Congress on Medical Physics and Biomedical Engineering, May 26-31, 2012, Beijing, China. IFMBE Proceedings
Study on the Genotoxicity of the Extremely Low Frequency-Magnetic Fields (ELF-MF) in Occupationally Exposed Workers

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering
Authors: Gobba, F., Korpinen, L., Scaringi, M., Bravo, G.
Number of pages: 6
Pages: 258-263
Publication date: 2013

Host publication information
Title of host publication: 2013 CIGRE, 3rd International Colloquium on Low Frequency Electromagnetic Fields (EMF-ELF 2013), Proceedings, October 15 to 16, 2013, Nara, Japan
Publisher: International Council on Large Electric Systems CIGRE
Article number: B-P-13

Publication series
Name: International Colloquium on Low Frequency Electromagnetic Fields

Bibliographical note
Contribution: organisation=elt,FACT1=1
Portfolio EDEND: 2013-10-29
Publisher name: International Council on Large Electric Systems CIGRE

Sähkö- ja elektroniikkateollisuuden ympäristökysymykset

General information
State: Published
Ministry of Education publication type: D5 Text book, professional manual or guide or a dictionary
Organisations: Department of Electronics and Communications Engineering
Authors: Korpinen, L., Alanko, T.
Number of pages: 120
Publication date: 2013

Publication information
Publisher: Tampereen Teknillinen Yliopisto
Original language: Finnish

Publication series
Name: Tampereen teknillinen yliopisto. Elektroniikan ja tietoliiketekniikan laitos. Opetusmoniste
No.: 1
ISSN (Print): 2341-7536
Testing Cardiac Pacemakers and Implantable cardioverter defibrillators (ICD) with a human-shaped phantom in the electric and magnetic fields of 400-kV power lines and of 400-kV substations

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering
Authors: Kuisti, H., Korpinen, L., Elovaara, J., Virtanen, V.
Number of pages: 4
Pages: 354-357
Publication date: 2013

Host publication information
Title of host publication: 2013 CIGRE, 3rd International Colloquium on Low Frequency Electromagnetic Fields (EMF-ELF 2013), Proceedings, October 15 to 16, 2013, Nara, Japan
Publisher: International Council on Large Electric Systems CIGRE
Article number: C-O-09

Publication series
Name: International Colloquium on Low Frequency Electromagnetic Fields

Bibliographical note
Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2013-10-29
Publisher name: International Council on Large Electric Systems CIGRE
Source: researchoutputwizard
Source-ID: 2649
Research output: Scientific - peer-review › Conference contribution

Reliability of UHF RFID tags in humid environments

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering
Authors: Saarinen, K., Frisk, L.
Number of pages: 5
Pages: 180-184
Publication date: 2012

Host publication information
Title of host publication: 2012 IEEE 14th Electronics Packaging Technology Conference, EPTC 2012, 5-7 December, Singapore
ISBN (Print): 978-1-4673-4553-8
ISBN (Electronic): 978-1-4673-4551-4

Publication series
Name: Electronics Packaging Technology Conference
DOIs:
10.1109/EPTC.2012.6507074

Bibliographical note
79369<br/>Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2013-11-29
Source: researchoutputwizard
Source-ID: 5236
Research output: Scientific - peer-review › Conference contribution

Menetelmä visuaalisen informaation generoimiseksi