A Reduced-Order Two-Degree-of-Freedom Composite Nonlinear Feedback Control for a Rotary DC Servo Motor

We study in this paper nonlinear control of a rotary DC servo motor application. To be more specific, we design a reduced-order two-degree-of-freedom (2DOF) composite nonlinear feedback (CNF) controller for a Quanser QUBE-Servo 2 unit with a disc attachment. We compare our results with a carefully tuned proportional-derivative (PD) controller with set point weighting. Our simulation and experimental results show that the closed-loop system using 2DOF CNF controller yields much better set point tracking performance compared with the system using conventional PD-controller in terms of settling time.

Analysis of common rail pressure signal of dual-fuel large industrial engine for identification of injection duration of pilot diesel injectors

In this paper, we address the problem of identification of injection duration of common rail (CR) diesel pilot injectors of dual-fuel engines. In these pilot injectors, the injected volume is small and the repeatability of injections and identification of drifts of injectors are important factors, which need to be taken into account in order to achieve good repeatability (shot-to-shot with every cylinder) and therefore a well-balanced engine and furthermore reduced overall wear. This information can then be used for calibration and diagnostics purposes to guarantee engine longevity facilitated by consistent operating conditions throughout the life of the unit. A diagnostics method based on analysis of CR pressure with experimental results is presented in this paper. Using the developed method, the relative duration of injection events can be identified for multiple injectors. We use the phenomenon of drop in rail pressure due to an injection event as a feature of the injection process. The method is based on filtered CR pressure data during and after the injection event. First, the pressure signal during injection is extracted after control of each injection event. After that, the signal is normalized and filtered. Then a derivative of the filtered signal is calculated. Change in the derivative of the filtered signal larger than a predefined threshold indicates an injection event that can be detected and its relative duration can be identified. We present the experimental results and demonstrate the efficacy of the proposed methods using different types of pressure sensors. We are able to properly identify a change of ≥10 μs (2%, 500 μs) in injection time. This shows that the developed method detects drifts in injection duration and the magnitude of drift. This information can be used for adaptive control of injection duration, so that finally the injected fuel volume is the same as the original.
Scopus rating (2016): CiteScore 4.9 SJR 1.744 SNIP 2.179
Scopus rating (2015): SJR 1.809 SNIP 2.125 CiteScore 4.46
Scopus rating (2014): SJR 1.667 SNIP 2.331 CiteScore 4.14
Scopus rating (2013): SJR 1.811 SNIP 2.595 CiteScore 4.31
Scopus rating (2012): SJR 1.852 SNIP 2.465 CiteScore 3.99
Scopus rating (2011): SJR 2.093 SNIP 2.427 CiteScore 4.1
Scopus rating (2010): SJR 1.984 SNIP 2.319
Scopus rating (2009): SJR 2.012 SNIP 2.277
Scopus rating (2008): SJR 1.635 SNIP 2.184
Scopus rating (2007): SJR 1.383 SNIP 1.86
Scopus rating (2006): SJR 1.278 SNIP 1.64
Scopus rating (2005): SJR 1.623 SNIP 1.73
Scopus rating (2004): SJR 1.273 SNIP 1.883
Scopus rating (2003): SJR 1.103 SNIP 1.481
Scopus rating (2002): SJR 1.13 SNIP 1.301
Scopus rating (2001): SJR 1.136 SNIP 1.264
Scopus rating (2000): SJR 1.047 SNIP 1.272
Scopus rating (1999): SJR 1.117 SNIP 1.157

Original language: English
Keywords: Analysis, Dual-fuel engine, Diesel, Common rail, Injector, Rail pressure
ASJC Scopus subject areas: Mechanical Engineering, Signal Processing, Modelling and Simulation, Applied Mathematics

Research output: Scientific - peer-review › Article

Opiskelijoiden oppimisyöksyjen käyttö tietokoneavusteisessa Matematiikkajumppa -tukiopeutuksessa

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Authors: Myllykoski, T., Ali-Löytty, S. S., Pohjolainen, S.
Number of pages: 12
Pages: 54-65
Publication date: 31 Oct 2017

Host publication information
Title of host publication: 2017: Proceedings of the annual FMSERA symposium 2016

Publication series
Name: Proceedings of the FMSERA annual symposium
Publisher: Finnish Mathematics and Science Education Research Association (FMSERA)
ISSN (Electronic): 2489-4583
ASJC Scopus subject areas: Mathematics(all)
Electronic versions:
Myllykoski_FIMSERA
Links:
https://journal.fi/fmsera/article/view/60937
http://urn.fi/URN:NBN:fi:tty-201711082120
Research output: Scientific - peer-review › Conference contribution
Sähköisen matematiikan tentin toteuttaminen ja opiskelijoiden kokemukset sähköisestä tentistä


General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Teaching and Learning Services, Mathematics, Research group: Positioning
Authors: Koskinen, S., Kela, J., Ali-Löytty, S. S., Joutsenlahti, J.
Number of pages: 11
Pages: 110-120
Publication date: 31 Oct 2017

Host publication information
Title of host publication: 2017: Proceedings of the annual FMSERA symposium 2016

Publication series
Name: Proceedings of the FMSERA annual symposium
Publisher: Finnish Mathematics and Science Education Research Association (FMSERA)
ISSN (Electronic): 2489-4583
Electronic versions:
Koskinen_FMSERA
Links:
https://journal.fi/fmsera/article/view/60927
http://urn.fi/URN:NBN:fi:tty-201711082122

Bibliographical note
INT="Kela, Jesse"
Research output: Scientific - peer-review > Conference contribution

Semantic Labeling of User Location Context Based on Phone Usage Features

In mobile phones, the awareness of the user’s context allows services better tailored to the user’s needs. We propose a machine learning based method for semantic labeling that utilizes phone usage features to detect the user’s home, work, and other visited places. For place detection, we compare seven different classification methods. We organize the phone usage data based on periods of uninterrupted time that the user has been in a certain place. We consider three approaches to represent this data: visits, places, and cumulative samples. Our main contribution is semantic place labeling using a small set of privacy-preserving features and novel data representations suitable for resource constrained mobile devices. The contributions include (1) introduction of novel data representations including accumulation and averaging of the usage, (2) analysis of the effect of the data accumulation time on the accuracy of the place classification, (3) analysis of the confidence on the classification outcome, and (4) identification of the most relevant features obtained through feature selection methods. With a small set of privacy-preserving features and our data representations, we detect the user’s home and work with probability of 90% or better, and in 3-class problem the overall classification accuracy was 89% or better.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Authors: Leppäkoski, H., Rivero-Rodriguez, A., Rautalain, S., Muñoz Martinez, D., Käppi, J., Ali-Löytty, S., Piche, R.
Number of pages: 21
Pages: 1-21
Publication date: 24 Aug 2017
Peer-reviewed: Yes

Publication information
Output Regulation of Infinite-Dimensional Time-Delay Systems

We study output tracking and disturbance rejection for linear infinite-dimensional time-delay systems using dynamic error feedback controllers with state delays. The class of systems covers many partial differential equations with state, input, and output delays. As our main result we characterize the solvability of the control problem in terms of the solvability of the associated regulator equations.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Mathematics, Research group: Computer Science and Applied Logics
Authors: Paunonen, L.
Number of pages: 5
Pages: 3189-3193
Publication date: May 2017

Host publication information
Title of host publication: American Control Conference (ACC), 2017
Publisher: IEEE
ISBN (Electronic): 978-1-5090-5992-8

Publication series
Name: Proceedings of the American Control Conference
Publisher: IEEE
Volume: 2017
ISSN (Print): 0743-1619
ISSN (Electronic): 2378-5861
ASJC Scopus subject areas: Analysis, Control and Systems Engineering
Electronic versions:
Accepted manuscript
DOIs:
10.23919/ACC.2017.7963438
Links:
http://urn.fi/URN:NBN:fi:tty-201707271634

Research output: Scientific - peer-review › Conference contribution
The logics taught and used at high schools are not the same
Typical treatises on propositional and predicate logic do not tell how to deal with undefined expressions, such as division by zero. However, there seems to be a sound (albeit inexplicit) reasoning system that addresses undefined expressions, because equations and inequations involving them are routinely solved in schools and universities without running into fundamental inconsistencies. In this study we discover this school logic and formalize its semantics. The need to do so arose when developing software that gives students feedback on every reasoning step of their solution, instead of just telling whether the roots that they finally report are the correct roots. The problem of undefined expressions has been addressed in computer science. However, school logic proves different from those approaches. School logic is based on a Kleene-style third "undefined" truth value and the treatment of "$\rightarrow$" and "$\iff$" not as propositional operators but as reasoning operators.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Pervasive Computing, University of Tampere
Authors: Valmari, A., Hella, L.
Number of pages: 15
Pages: 172-186
Publication date: May 2017

Host publication information
Title of host publication: Proceedings of the Fourth Russian Finnish Symposium on Discrete Mathematics
Place of publication: Turku
Publisher: TURKU CENTRE FOR COMPUTER SCIENCE
Editors: Karhumäki, J., Matiyasevich, Y., Saarela, A.
ISBN (Print): 978-952-12-3547-4

Publication series
Name: TUCS Lecture Notes
Publisher: Turku Centre for Computer Science
No.: 26
ISSN (Print): 1797-8823
ASJC Scopus subject areas: Mathematics(all)
Keywords: logic
Links:
http://www.doria.fi/handle/10024/143322
Research output: Scientific - peer-review » Conference contribution

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.

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: Wireless Communications and Positioning, Department of Mathematics, Research group: MAT Intelligent Information Systems Laboratory, Research group: System-on-Chip for GNSS, Wireless Communications and Cyber-Physical Embedded Computing, Chalmers University of Technology
Authors: Lohan, E., Seco-Granados, G., Wymeersch, H., Nykänen, O., Nurmi, J.
Pages: 331-332
Publication date: 2017

Host publication information
Title of host publication: Multi-Technology Positioning
Publisher: Springer
ISBN (Print): 978-3-319-50426-1
ISBN (Electronic): 978-3-319-50427-8
DOIs: 10.1007/978-3-319-50427-8_17
Research output: Scientific - peer-review » Chapter
Independent Loops Search in Flow Networks Aiming for Well-Conditioned System of Equations

We approach the problem of choosing linearly independent loops in a pipeflow network as choosing the best-conditioned submatrix of a given larger matrix. We present some existing results of graph theory and submatrix selection problems, based on which we construct three heuristic algorithms for choosing the loops. The heuristics are tested on two pipeflow networks that differ significantly on the distribution of pipes and nodes in the network.

General information
State: E-pub ahead of print
Ministry of Education publication type: A4 Article in a conference publication
Authors: Humaloja, J., Ali-Löytty, S., Pohjolainen, S., Hämäläinen, T.
Publication date: 2017

Host publication information
Title of host publication: Progress in Industrial Mathematics at ECMI 2016
Publisher: Springer International Publishing
ISBN (Print): 978-3-319-63081-6
ISBN (Electronic): 978-3-319-63082-3

Publication series
Name: Mathematics in industry
Publisher: Springer
Volume: 26
ISSN (Print): 1612-3956
ISSN (Electronic): 2198-3283
Keywords: pipeflow analysis, independent loops
ASJC Scopus subject areas: Applied Mathematics, Modelling and Simulation
DOIs:
10.1007/978-3-319-63082-3

Links:
https://www.springer.com/gp/book/9783319630816
Research output: Scientific - peer-review › Conference contribution

Kullback-Leibler Divergence Approach to Partitioned Update Kalman Filter
Kalman filtering is a widely used framework for Bayesian estimation. The partitioned update Kalman filter applies a Kalman filter update in parts so that the most linear parts of measurements are applied first. In this paper, we generalize partitioned update Kalman filter, which requires the use of the second order extended Kalman filter, so that it can be used with any Kalman filter extension such as the unscented Kalman filter. To do so, we use a Kullback-Leibler divergence approach to measure the nonlinearity of the measurement, which is theoretically more sound than the nonlinearity measure used in the original partitioned update Kalman filter. Results show that the use of the proposed partitioned update filter improves the estimation accuracy.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Automation Science and Engineering, Research area: Dynamic Systems, Research group: Positioning
Authors: Raitoharju, M., García-Fernández, Á., Piche, R.
Publication date: 2017
Peer-reviewed: Yes

Publication information
Journal: Signal Processing
Volume: 130
ISSN (Print): 0165-1684
Ratings:
Scopus rating (2016): CiteScore 3.6 SJR 1.048 SNIP 1.905
Scopus rating (2015): SJR 0.958 SNIP 2.001 CiteScore 3
Scopus rating (2014): SJR 1.059 SNIP 2.311 CiteScore 3.19
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-Technology Positioning

General information
State: Published
Ministry of Education publication type: C2 Edited books
Organisations: Department of Electronics and Communications Engineering, Research group: System-on-Chip for GNSS, Wireless Communications and Cyber-Physical Embedded Computing, Research group: Wireless Communications and Positioning, Department of Mathematics, Research group: MAT Intelligent Information Systems Laboratory, Chalmers University of Technology
Publication date: 2017

Publication information
Publisher: Springer
ISBN (Print): 978-3-319-50426-1
ISBN (Electronic): 978-3-319-50427-8
Original language: English
ASJC Scopus subject areas: Electrical and Electronic Engineering, Aerospace Engineering
DOIs: 10.1007/978-3-319-50427-8
Research output: Scientific - peer-review › Anthology
Two-Sided Hypergenic Functions
In this paper we present an analogous of the class of two-sided axial monogenic functions to the case of axial κ-hypermonogenic functions. In order to do that we will solve a Vekua-type system in terms of Bessel functions.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Mathematics, Research group: MAT Clifford analysis, Department of Mathematics, CIDMA, Center for Research and Development in Mathematics and Applications
Authors: Eriksson, S., Orelma, H., Vieira, N.
Number of pages: 14
Pages: 111–123
Publication date: 2017
Peer-reviewed: Yes
Early online date: 12 Sep 2015

Publication information
Journal: Advances in Applied Clifford Algebras
Volume: 27
Issue number: 1
ISSN (Print): 0188-7009

Ratings:
Scopus rating (2016): SJR 0.353 SNIP 1.199 CiteScore 0.74
Scopus rating (2015): SJR 0.313 SNIP 1.091 CiteScore 0.61
Scopus rating (2014): SJR 0.332 SNIP 0.743 CiteScore 0.56
Scopus rating (2013): SJR 0.433 SNIP 1.215 CiteScore 0.66
Scopus rating (2012): SJR 0.593 SNIP 0.96 CiteScore 0.62
Scopus rating (2011): SJR 0.4 SNIP 0.95 CiteScore 0.49
Scopus rating (2010): SJR 0.405 SNIP 0.904
Scopus rating (2009): SJR 0.338 SNIP 0.96
Scopus rating (2008): SJR 0.258 SNIP 0.73
Scopus rating (2007): SJR 0.283 SNIP 0.934
Scopus rating (2006): SJR 0.247 SNIP 0.083
Scopus rating (2005): SJR 0.143 SNIP 0.392
Original language: English
Keywords: $\kappa$-Hypergenic functions, Clifford algebras, Hypergenic functions, Two-side hypergenic functions
ASJC Scopus subject areas: Applied Mathematics

Distribution of spin-axes longitudes and shape elongations of main-belt asteroids

General information
State: E-pub ahead of print
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Mathematics, Research group: MAT Inverse Problems
Authors: Cibulkova, H., Durech, J., Vokrouhlicky, D., Kaasalainen, M., Oszkiewicz, D. A.
Number of pages: 10
Publication date: 30 Nov 2016
Peer-reviewed: Yes

Publication information
Journal: Astronomy and Astrophysics
Volume: 596
Article number: A57
Students’ Use of Learning Tools and Tool Types: Solving Self-Study Assignments on an Online Platform

Since 2002, a test titled Mathematics Basic Skills Test (BST) has been organized annually at Tampere University of Technology. In order to pass the Basic Skills Test, a student should be able to complete a set amount out of the 16 assignments within 45 minutes (in fall of 2015, the passing limit was 6 for engineering students, 8 for science and mathematics students). Students who failed the test were directed to the Remedial Instruction (RI). The Remedial Instruction is a set of 71 high school mathematics problems designed to brush up the skills of engineering students.

TUT students have, since 2006, been divided into different learner profile groups. This paper is the summary of studies on the behaviour of these different learner profile groups in the Remedial Instruction regarding their use of time and learning tools when solving their assignments.

Different types of learners indicate that their self-study habits on an online platform are very different. Students that are surface oriented in their studies use a lot of different learning tools, but do not produce good examination results. Skillful students seem to do well even without using a lot of tools. Thus, the current way at TUT, where students work on their remedial mathematics problems on their own could be developed further. Some change is needed, and one suggestion is using testing to ensure that the remedial training has had the desired effect.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Mathematics, Research group: MAT Intelligent Information Systems Laboratory, Research group: MAT Positioning
Authors: Myllykoski, T., Pohjolainen, S., Ali-Löytty, S.
Publication date: 16 Sep 2016

Host publication information
Title of host publication: SEFI 2016 Annual Conference Proceedings: Engineering Education on Top of the World: Industry University Cooperation
Publisher: European Society for Engineering Education SEFI
ISBN (Electronic): 9782873520144
Keywords: math-bridge, mathematics teaching, e-learning
Links:
Research output: Scientific - peer-review » Conference contribution
Developing Learning and Teaching in Engineering Mathematics with and without Technology

University teachers of mathematics have begun to observe that nowadays new students when beginning their studies do not have as good a mathematical proficiency as before. The phenomenon has been noticed in all western countries during recent decades [1, 2]. What shall we do? We think that there are at least two available courses of action for improved learning results in university mathematics: 1) to identify as soon as possible the students who have an insufficient knowledge base in mathematics, and to begin remedial instruction for them, and 2) to develop mathematics learning environments both with and without technology.

The aim of this paper is to describe how Tampere University of Technology (TUT) has developed learning environments in mathematics during the last decade. We focus in the paper on two cases: 1) a multisemiotic approach to mathematical concepts and procedures, and 2) computer aided assessment and learning systems.

The first case consists of developing studies in mathematical exercises in which new kinds of problem-solving have been constructed. In the second case new students have participated in an ICT -based basic test at the beginning of their mathematics studies, to enable them to practice mathematical procedures in solving processes [3]. Electronic and web-based tools make it possible for students to learn independently at any time, and for teachers, offer an effective way to evaluate students' proficiency.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Authors: Joutsenlahti, J., Ali-Löytty, S., Pohjolainen, S.
Publication date: 15 Sep 2016

Host publication information
Title of host publication: SEFI 2016 Annual Conference Proceedings : Engineering Education on Top of the World: Industry University Cooperation
Publisher: European Society for Engineering Education SEFI
ISBN (Electronic): 9782873520144
Research output: Scientific - peer-review » Conference contribution

Planning for robotic exploration based on forward simulation
We address the problem of controlling a mobile robot to explore a partially known environment. The robot’s objective is the maximization of the amount of information collected about the environment. We formulate the problem as a partially observable Markov decision process (POMDP) with an information-theoretic objective function, and solve it applying forward simulation algorithms with an open-loop approximation. We present a new sample-based approximation for mutual information useful in mobile robotics. The approximation can be seamlessly integrated with forward simulation planning algorithms. We investigate the usefulness of POMDP based planning for exploration, and to alleviate some of its weaknesses propose a combination with frontier based exploration. Experimental results in simulated and real environments show that, depending on the environment, applying POMDP based planning for exploration can improve performance over frontier exploration.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Automation Science and Engineering
Authors: Lauri, M., Ritala, R.
Number of pages: 17
Pages: 15-31
Publication date: 1 Sep 2016
Peer-reviewed: Yes

Publication information
Journal: ROBOTICS AND AUTONOMOUS SYSTEMS
Volume: 83
ISSN (Print): 0921-8890
Ratings:
Scopus rating (2016): SJR 1.076 SNIP 2.064 CiteScore 3.67
Asymptotic Behaviour of Platoon Systems

In this paper we study the asymptotic behaviour of various platoon-type systems using the general theory developed by the authors in a recent article. The aim is to steer an infinite number of vehicles towards a target configuration in which each vehicle has a prescribed separation from its neighbour and all vehicles are moving at a given velocity. More specifically, we study systems in which state feedback is possible, systems in which observer-based dynamic output feedback is required, and also a situation in which the control objective is modified to allow the target separations to depend on the vehicles’ velocities. We show that in the first and third cases the objective can be achieved, but that in the second case the system is unstable in the sense that the associated semigroup is not uniformly bounded. We also present some quantified results concerning the rate of convergence of the platoon to its limit state when the limit exists.

General information

State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Mathematics, Research group: MAT Mathematical and semantic modelling, University of Oxford
Authors: Paunonen, L., Seifert, D.
Number of pages: 7
Pages: 830-836
Publication date: Jul 2016

Host publication information

Title of host publication: Proceedings of the 22nd International Symposium on Mathematical Theory of Networks and Systems
Publisher: University of Minnesota
Keywords: Vehicle platoon, ordinary differential equations, asymptotic behaviour, state feedback, rates of convergence
ASJC Scopus subject areas: Analysis, Control and Optimization
Electronic versions:
Paunonen & Seifert - MTNS 2016 preprint
Links:
http://hdl.handle.net/11299/181518
Research output: Scientific - peer-review > Conference contribution
Acoustic Modelling

Let us examine the behaviour of sound in a gas or in a liquid medium. From a physical point of view, the sound we hear is created by the pressure change in the medium surrounding us that is sensed by our ears. The equations describing the behaviour of a liquid or a gas are based on well-known equations of fluid mechanics. Therefore in acoustics, they are often referred to as fluids. In the following sections we present a simple wave equation, which is the simplest of (linear) equations used to model acoustical phenomena. Even though the wave equation is quite a simplified model, it has proven to be extremely useful for describing the behaviour of sound in the most common fluid we face every day, namely air.

General information
State: Published
Ministry of Education publication type: A3 Part of a book or another research book
Organisations: Department of Mathematics, Research group: MAT Intelligent Information Systems Laboratory, Research group: MAT Mathematical and semantic modelling, Tampere Univ Technol, Tampere University of Technology
Authors: Pohjolainen, S., Suutala, A.
Number of pages: 21
Pages: 185-205
Publication date: 30 Jun 2016

Host publication information
Title of host publication: Mathematical Modelling
Place of publication: Switzerland
Publisher: Springer
Editor: Pohjolainen, S.
ISBN (Print): 978-3-319-27834-6
ISBN (Electronic): 978-3-319-27836-0
ASJC Scopus subject areas: Applied Mathematics, Modelling and Simulation, Acoustics and Ultrasonics
DOIs:
10.1007/978-3-319-27836-0_11

Bibliographical note
INT=mat,"Suutala, Antti"
Research output: Scientific - peer-review › Chapter

Geometric solution strategy of Laplace problems with free boundary
This paper introduces a geometric solution strategy for Laplace problems. Our main interest and emphasis is on efficient solution of the inverse problem with a boundary with Cauchy condition and with a free boundary. This type of problem is known to be sensitive to small errors. We start from the standard Laplace problem and establish the geometric solution strategy on the idea of deforming equipotential layers continuously along the field lines from one layer to another. This results in exploiting ordinary differential equations to solve any boundary value problem that belongs to the class of Laplace's problem. Interpretation in terms of a geometric flow will provide us with stability considerations. The approach is demonstrated with several examples.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Research area: Electromagnetics, Department of Electrical Engineering
Authors: Poutala, A., Tarhasaari, T., Kettunen, L.
Number of pages: 24
Pages: 723-746
Publication date: 9 Mar 2016
Peer-reviewed: Yes

Publication information
Volume: 105
Issue number: 10
ISSN (Print): 0029-5981
Ratings:
Scopus rating (2016): SJR 1.743 SNIP 1.566 CiteScore 2.64
Scopus rating (2015): SJR 1.912 SNIP 1.689 CiteScore 2.67
Scopus rating (2014): SJR 1.935 SNIP 1.927 CiteScore 2.73
Scopus rating (2013): SJR 2.415 SNIP 1.894 CiteScore 2.8
Scopus rating (2012): SJR 2.47 SNIP 2.103 CiteScore 2.7
Scopus rating (2011): SJR 2.193 SNIP 1.935 CiteScore 2.47
Studying the various properties of MIN and MAX matrices - elementary vs. more advanced methods

Let $T = \{z_1, z_2, \ldots, z_n\}$ be a finite multiset of real numbers, where $z_1 \leq z_2 \leq \cdots \leq z_n$. The purpose of this article is to study the different properties of MIN and MAX matrices of the set $T$ with $\min(z_i, z_j)$ and $\max(z_i, z_j)$ as their $ij$ entries, respectively. We are going to do this by interpreting these matrices as so-called meet and join matrices and by applying some known results for meet and join matrices. Once the theorems are found with the aid of advanced methods, we also consider whether it would be possible to prove these same results by using elementary matrix methods only. In many cases the answer is positive.
We present three dynamic error feedback controllers for robust output regulation of regular linear systems. These controllers are (i) a minimal order robust controller for exponentially stable systems (ii) an observer-based robust controller and (iii) a new internal model based robust controller structure. In addition, we present two controllers that are by construction robust with respect to predefined classes of perturbations. The results are illustrated with an example where we study robust output tracking of a sinusoidal reference signal for a two-dimensional heat equation with boundary control and observation.
Data-based stochastic modeling of tree growth and structure formation

We introduce a general procedure to match a stochastic functional-structural tree model (here LIGNUM augmented with stochastic rules) with real tree structures depicted by quantitative structure models (QSMs) based on terrestrial laser scanning. The matching is done by iteratively finding the maximum correspondence between the measured tree structure and the stochastic choices of the algorithm. First, we analyze the match to synthetic data (generated by the model itself), where the target values of the parameters to be estimated are known in advance, and show that the algorithm converges properly. We then carry out the procedure on real data obtaining a realistic model. We thus conclude that the proposed stochastic structure model (SSM) approach is a viable solution for formulating realistic plant models based on data and accounting for the stochastic influences.
Further hardness results on rainbow and strong rainbow connectivity

A path in an edge-colored graph is rainbow if no two edges of it are colored the same. The graph is said to be rainbow connected if there is a rainbow path between every pair of vertices. If there is a rainbow shortest path between every pair of vertices, the graph is strong rainbow connected. We consider the complexity of the problem of deciding if a given edge-colored graph is rainbow or strong rainbow connected. These problems are called Rainbow connectivity and Strong rainbow connectivity, respectively. We prove both problems remain NP-complete on interval outerplanar graphs and k-regular graphs for k≥3. Previously, no graph class was known where the complexity of the two problems would differ. We show that for block graphs, which form a subclass of chordal graphs, Rainbow connectivity is NP-complete while Strong rainbow connectivity is in P. We conclude by considering some tractable special cases, and show for instance that both problems are in XP when parameterized by tree-depth.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Mathematics
Authors: Lauri, J.
Pages: 191-200
Publication date: 2016
Peer-reviewed: Yes

Publication information
Journal: Discrete Applied Mathematics
Volume: 201
ISSN (Print): 0166-218X
Ratings:
Scopus rating (2016): SJR 0.823 SNIP 1.17 CiteScore 1
Scopus rating (2015): SJR 0.795 SNIP 1.164 CiteScore 0.89
Scopus rating (2014): SJR 0.902 SNIP 1.396 CiteScore 0.99
Scopus rating (2013): SJR 0.762 SNIP 1.451 CiteScore 1.03
Scopus rating (2012): SJR 0.8 SNIP 1.35 CiteScore 1
Scopus rating (2011): SJR 0.846 SNIP 1.206 CiteScore 1.01
Scopus rating (2010): SJR 0.794 SNIP 1.163
Scopus rating (2009): SJR 0.82 SNIP 1.375
Scopus rating (2008): SJR 0.911 SNIP 1.573
Scopus rating (2007): SJR 0.819 SNIP 1.117
Scopus rating (2006): SJR 0.779 SNIP 1.186
Scopus rating (2005): SJR 0.767 SNIP 1.337
Scopus rating (2004): SJR 0.677 SNIP 1.251
Scopus rating (2003): SJR 0.71 SNIP 1.219
Scopus rating (2002): SJR 0.674 SNIP 1.085
Scopus rating (2001): SJR 0.635 SNIP 0.998
Scopus rating (2000): SJR 0.439 SNIP 0.776
Scopus rating (1999): SJR 0.413 SNIP 0.737
Original language: English
Keywords: Computational complexity, Rainbow connectivity
ASJC Scopus subject areas: Applied Mathematics, Discrete Mathematics and Combinatorics
DOIs:
10.1016/j.dam.2015.07.041
Source: Scopus
Source-ID: 84956591316
Research output: Scientific › peer-review › Article

Moodle työpaja: Vertaisarviointi osana opetusta yliopistomatematiikan ensimmäisellä peruskurssilla

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Mathematics, Research group: MAT Positioning
Authors: Mäkelä, A., Ali-Löytty, S., Joutsenlahti, J., Kauhanen, J.
On Detecting the Shape of an Unknown Object in an Electric Field

The problem discussed in this paper is detecting the shape of an unknown object in a 2-dimensional static electric field. For simplicity, the problem is defined in a partially rectangular domain, where on a part of the boundary the potential and/or its normal derivative are known. On the other part of the boundary the boundary curve is unknown, and this curve is to be determined. The unknown part of the boundary curve describes the shape of the unknown object.

The problem is defined in the complex plane by an analytic function \( w = f(z) = u(x,y) + iv(x,y) \) with the potential \( u \) as its real part. Then the inverse function is given as \( f^{-1}(w) = x(u,v) + iy(u,v) \), where the functions \( x \) and \( y \) are harmonic in a rectangle with an unknown boundary condition on one boundary. The alternating-field technique is used to solve the unknown boundary condition.

General information
State: Accepted/In press
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Mathematics, Research group: MAT Mathematical and semantic modelling, Research group: MAT Intelligent Information Systems Laboratory
Authors: Humaloja, J., Hämäläinen, T., Pohjolainen, S.
Publication date: 2016

Host publication information
Title of host publication: Progress in Industrial Mathematics at ECMI 2014
Publisher: Springer International Publishing
Editors: Russo, G., Capasso, V., Nicosia, G., Romano, V.
ISBN (Print): 978-3-319-23412-0
ISBN (Electronic): 978-3-319-23413-7

Publication series
Name: Mathematics in Industry
Publisher: Springer-Verlag
Volume: 22
ISSN (Electronic): 1612-3956
Keywords: free boundary problem, industrial mathematics
DOI:
10.1007/978-3-319-23413-7
Links:
http://urn.fi/URN:NBN:fi:itty-201606014205. No embargo end date input

Bibliographical note
Embargo avoinna, koska ei vielä julkaistu (Due May 3, 2017)
HO / 2.5.2016
Research output: Scientific - peer-review » Conference contribution

On k-Hypermonogenic Functions and Their Mean Value Properties

We study a hyperbolic version of holomorphic functions to higher dimensions. In this frame work, a generalization of holomorphic functions are called (Formula presented.)-hypermonogenic functions. These functions are depending on several real variables and their values are in a Clifford algebra. They are defined in terms of hyperbolic Dirac operators. They are connected to harmonic functions with respect to the Riemannian metric (Formula presented.) in the same way as the usual harmonic function to holomorphic functions. We present the mean value property for (Formula presented.)-
hypermonogenic functions and related results. Earlier the mean value properties has been proved for hypermonogenic functions. The key tools are the invariance properties of the hyperbolic metric.

### General information
- **State:** Published
- **Ministry of Education publication type:** A1 Journal article-refereed
- **Organisations:** Department of Mathematics, Research group: MAT Clifford analysis
- **Authors:** Eriksson, S., Orelma, H.
- **Number of pages:** 15
- **Pages:** 311-325
- **Publication date:** 2016
- **Peer-reviewed:** Yes
- **Early online date:** 8 Mar 2015

### Publication information
- **Journal:** Complex Analysis and Operator Theory
- **Volume:** 10
- **Issue number:** 2
- **ISSN (Print):** 1661-8254
- **Ratings:**
  - Scopus rating (2016): CiteScore 0.57 SJR 0.564 SNIP 0.795
  - Scopus rating (2015): SJR 0.553 SNIP 0.78 CiteScore 0.54
  - Scopus rating (2014): SJR 0.793 SNIP 0.974 CiteScore 0.69
  - Scopus rating (2013): SJR 0.71 SNIP 0.841 CiteScore 0.56
  - Scopus rating (2012): SJR 0.591 SNIP 0.728 CiteScore 0.49
  - Scopus rating (2011): SJR 0.805 SNIP 1.049 CiteScore 0.54
  - Scopus rating (2010): SJR 0.637 SNIP 0.968
  - Scopus rating (2009): SJR 0.604 SNIP 1.232
  - Scopus rating (2008): SJR 0.402 SNIP 1.743
- **Original language:** English
- **ASJC Scopus subject areas:** Applied Mathematics, Computational Mathematics, Computational Theory and Mathematics
- **Keywords:** Dirac operator, Hyperbolic metric, Hypermonogenic, Monogenic
- **DOIs:** 10.1007/s11785-015-0445-z
- **Source:** Scopus
- **Source-ID:** 84955725749
- **Research output:** Scientific - peer-review » Article

### Online tests of Kalman filter consistency
The normalised innovation squared (NIS) test, which is used to assess whether a Kalman filter's noise assumptions are consistent with realised measurements, can be applied online with real data, and does not require future data, repeated experiments or knowledge of the true state. In this work, it is shown that the NIS test is equivalent to three other model criticism procedures, which are as follows: (i) it can be derived as a Bayesian p-test for the prior predictive distribution; (ii) as a nested-model parameter significance test; and (iii) from a recently-proposed filter residual test. A new NIS-like test corresponding to a posterior predictive Bayesian p-test is presented.

### General information
- **State:** Published
- **Ministry of Education publication type:** A1 Journal article-refereed
- **Organisations:** Department of Automation Science and Engineering, Research group: Positioning
- **Authors:** Piché, R.
- **Pages:** 115–124
- **Publication date:** 2016
- **Peer-reviewed:** Yes

### Publication information
- **Journal:** International Journal of Adaptive Control and Signal Processing
- **Volume:** 30
- **Issue number:** 1
- **ISSN (Print):** 0890-6327
- **Ratings:**
  - Scopus rating (2016): SJR 0.886 SNIP 1.102 CiteScore 2.04
  - Scopus rating (2015): SJR 1.012 SNIP 1.084 CiteScore 1.69
Poincaré inverse problem and torus construction in phase space

The phase space of an integrable Hamiltonian system is foliated by invariant tori. For an arbitrary Hamiltonian $H$ such a foliation may not exist, but we can artificially construct one through a parameterised family of surfaces, with the intention of finding, in some sense, the closest integrable approximation to $H$. This is the Poincaré inverse problem (PIP). In this paper, we review the available methods of solving the PIP and present a new iterative approach which works well for the often problematic thin orbits.

General information

State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Mathematics, Research group: MAT Inverse Problems
Authors: Laakso, T., Kaasalainen, M.
Pages: 72-82
Publication date: 2016
Peer-reviewed: Yes
Early online date: 26 Oct 2015

Publication Information

Journal: Physica D: Nonlinear Phenomena
Volume: 315
ISSN (Print): 0167-2789
Ratings:

Scopus rating (2016): SJR 0.845 SNIP 1.266 CiteScore 1.71
Scopus rating (2015): SJR 1.035 SNIP 1.312 CiteScore 1.79
Scopus rating (2014): SJR 1.067 SNIP 1.204 CiteScore 1.71
Scopus rating (2013): SJR 1.029 SNIP 1.364 CiteScore 1.76
Scopus rating (2012): SJR 1.067 SNIP 1.234 CiteScore 1.69
Scopus rating (2011): SJR 0.959 SNIP 1.144 CiteScore 1.58
Scopus rating (2010): SJR 1.037 SNIP 1.11
Scopus rating (2009): SJR 1.009 SNIP 1.133
Robust Regulation for First-Order Port-Hamiltonian Systems

We present a method for obtaining robust control over a first-order port-Hamiltonian system. The presented method is especially designed for controlling impedance energy-preserving port-Hamiltonian systems. By combining the stabilization results of port-Hamiltonian systems and the theory of robust output regulation for exponentially stable systems, we design a simple finite-dimensional controller for an unstable system that together with output feedback achieves robust output regulation. The method is demonstrated on an example where we implement a robust regulating controller for the one-dimensional wave equation with boundary control and observation.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Mathematics, Research group: MAT Mathematical and semantic modelling, Research group: MAT Intelligent Information Systems Laboratory
Authors: Humaloja, J., Paunonen, L., Pohjolainen, S.
Number of pages: 6
Publication date: 2016

Host publication information
Title of host publication: Proceedings of the 15th European Control Conference, Aalborg, Denmark, June 29th - July 1st, 2016
Publisher: IEEE
ISBN (Electronic): 978-1-5090-2590-9
Keywords: Robust output regulation, port-Hamiltonian systems
ASJC Scopus subject areas: Control and Optimization
DOIs: 10.1109/ECC.2016.7810618
Research output: Scientific - peer-review » Conference contribution

Robust Regulation for Port-Hamiltonian Systems of Even Order

We present a controller that achieves robust regulation for a port-Hamiltonian system of even order. The controller is especially designed for impedance energy-preserving systems. By utilizing the stabilization results for port-Hamiltonian systems together with the theory of robust output regulation for exponentially stable systems, we construct a simple controller that solves the Robust Output Regulation Problem for an initially unstable system. The theory is illustrated on an example where we construct a controller for one-dimensional Schrödinger equation with boundary control and observation.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Mathematics, Research group: MAT Mathematical and semantic modelling, Research group: MAT Intelligent Information Systems Laboratory
Spectral density function of the Doob transformation of fractional Brownian motion (i.e. the fractional Ornstein-Uhlenbeck process)

In this work, we present a novel method for approximating a normal distribution with a weighted sum of normal distributions. The approximation is used for splitting normally distributed components in a Gaussian mixture filter, such that components have smaller covariances and cause smaller linearization errors when nonlinear measurements are used for the state update. Our splitting method uses weights from the binomial distribution as component weights. The method preserves the mean and covariance of the original normal distribution, and in addition, the resulting probability density and cumulative distribution functions converge to the original normal distribution when the number of components is increased. Furthermore, an algorithm is presented to do the splitting such as to keep the linearization error below a given threshold with a minimum number of components. The accuracy of the estimate provided by the proposed method is evaluated in four simulated single-update cases and one time series tracking case. In these tests, it is found that the proposed method is more accurate than other Gaussian mixture filters found in the literature when the same number of components is used and that the proposed method is faster and more accurate than particle filters.
Graph-Based Map Matching for Indoor Positioning

This article presents a probabilistic motion model that is based on an economical graph-based indoor map representation, such that the motion of the user is constrained according to the floor plan of a building. The floor plan is modeled as a combination of links and open space polygons that are connected by nodes. In the authors’ earlier work the link transition probabilities in this graph are proportional to the total link lengths that are the total lengths of the subgraphs accessible by choosing the considered link option, and this article extends this model to include open space polygons as well. A particle filter using the extended motion model in which all particles are constrained according to the map structure is presented. Furthermore, wireless local area network and Bluetooth Low Energy positioning tests show that the proposed algorithm outperforms comparison methods especially if the measurement rate is low.
Kalman filter with a linear state model for PDR+WLAN positioning and its application to assisting a particle filter

Indoor positioning based on wireless local area network (WLAN) signals is often enhanced using pedestrian dead reckoning (PDR) based on an inertial measurement unit. The state evolution model in PDR is usually nonlinear. We present a new linear state evolution model for PDR. In simulated-data and real-data tests of tightly coupled WLAN-PDR positioning, the positioning accuracy with this linear model is better than with the traditional models when the initial heading is not known, which is a common situation. The proposed method is computationally light and is also suitable for smoothing. Furthermore, we present modifications to WLAN positioning based on Gaussian coverage areas and show how a Kalman filter using the proposed model can be used for integrity monitoring and (re)initialization of a particle filter.
SimpleTree: An Efficient Open Source Tool to Build Tree Models from TLS Clouds

An open source tool named SimpleTree, capable of modelling highly accurate cylindrical tree models from terrestrial laser scan point clouds, is presented and evaluated. All important functionalities, accessible in the software via buttons and dialogues, are described including the explanation of all necessary input parameters. The method is validated utilizing 101 point clouds of six different tree species, in the main evergreen and coniferous trees. All scanned trees have been destructively harvested to get accurate estimates of above ground biomass with which we assess the accuracy of the SimpleTree-reconstructed cylinder models. The trees were grouped into four data sets and for each one a Concordance Correlation Coefficient of at least 0.92 (0.92, 0.97, 0.92, 0.94) and an total relative error at most ~8% (2.42%, 3.59%, –4.59%, 8.27%) was achieved in the comparison of the model results to the ground truth data. A global statistical improvement of derived cylinder radii is presented as well as an efficient optimization approach to automatically improve user given input parameters. An additional check of the SimpleTree results is presented via comparison to the results of trees reconstructed using an alternative, published method.

**General information**

State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Mathematics, Research group: MAT Inverse Problems, Mathematical modelling with wide societal impact (MathImpact)
Authors: Hackenberg, J., Spiecker, H., Calders, K., Disney, M., Raumonen, P.
Number of pages: 50
Pages: 4245-4294
Publication date: 23 Nov 2015
Peer-reviewed: Yes

**Publication information**

Journal: Forests: Open Access Journal
Volume: 6
Issue number: 11
ISSN (Print): 1999-4907
Ratings:
Scopus rating (2016): SJR 0.679 SNIP 0.923 CiteScore 2.06
Scopus rating (2015): SJR 0.632 SNIP 0.767 CiteScore 1.76
Scopus rating (2014): SJR 0.795 SNIP 0.972 CiteScore 1.84
Scopus rating (2013): SJR 0.633 SNIP 0.632 CiteScore 1.34
Scopus rating (2012): SJR 0.514 SNIP 0.912 CiteScore 1.18
Scopus rating (2011): SJR 0.25 SNIP 0.629
Original language: English
DOIs:
10.3390/f6114245
Links:
http://www.mdpi.com/1999-4907/6/11/4245 (Webpage of the article)
Research output: Scientific - peer-review › Article

**Fractional Ornstein-Uhlenbeck Processes**

In this monograph, we are mainly studying Gaussian processes, in particularly three different types of fractional Ornstein – Uhlenbeck processes. Pioneers in this field may be mentioned, e.g. Kolmogorov (1903-1987) and Mandelbrot (1924-2010). The Ornstein – Uhlenbeck diffusion can be constructed from Brownian motion via a Doob transformation and also from a solution of the Langevin stochastic differential equation. Both of these processes have the same finite dimensional distributions. However the solution of the Langevin stochastic differential equation, which driving process is fractionalBrownian motion and a Doob transformation of fractional Brownian motion do not have same finite dimensional distributions. Indeed we verify, that the covariance of the fractionalOrnstein – Uhlenbeck process of the first kind (which we call the solution of the Langevin stochastic differential equation in which the driving process is fractional Brownian motion)
behaves at infinity like a power function and the covariance of the fractional Ornstein–Uhlenbeck process (constructed by a Doob transformation of fractional Brownian motion) behaves at infinity like an exponential function. Moreover we study the behaviour of the covariances of these fractional Ornstein – Uhlenbeck processes. We also calculate the spectral density function for the Doob transformation of fractional Brownian motion using a Bochner theorem. We present the Doob transformation of fractional Brownian motion via solution of the Langevin stochastic differential equation. One of the main aims of our research is to analyse its driving process. This driving process is \( Y^\alpha(t) = e^{-\alpha t} x(t) \), where \( x(t) = (H e^{\alpha t}) / \alpha \) and \( Z(t) \) is fractional Brownian motion. We find out that the process \( Y^\alpha(t) = (Y^\alpha_t(t); t \geq 0) \), if scaled properly, has the same finite dimensional distributions as the process \( Y^1(t) = (Y^1_t(t); t \geq 0) \). The main result in this monograph is that we define a stationary fractional Ornstein–Uhlenbeck process of the second kind as a process with a two-sided driving process \( \{Y^\alpha_t(t); t \in \mathbb{R}\} \) and create a new family of fractional Ornstein-Uhlenbeck processes. We study many properties of the fractional Ornstein – Uhlenbeck process of the second kind. For example, we show that the fractional Ornstein–Uhlenbeck process of the second kind is Hölder continuous of any order \( \beta < H \) and find the kernel representation of its covariance. We research many properties of the processes \( Y^\alpha(t) \) and \( Y^1(t) \) since they are quite interesting themselves. We represent these processes as stochastic integrals with respect to Brownian motion and prove that the sample paths of the process \( Y^\alpha(t) \) are Hölder continuous of any order \( \beta < H \). In the case \( H \in (1/2, 1) \), we find out the covariance kernel of increment process of \( Y^\alpha(t) \), and using that we investigate the covariance of \( Y^\alpha(t) \) and the variance of \( Y^\alpha(t) \), when \( t \) tends to infinity. One of our main results is that the increment process of \( Y^\alpha(t) \) is short-range dependent. We also study weak convergence and tightness and then finally prove that \( 1/\alpha Y^\alpha_\alpha(t) \) converges weakly to scaled Brownian motion. In the case \( H \in (1/2, 1) \), fractional Brownian motion and the fractional Ornstein – Uhlenbeck process of the first kind both exhibit a long-range dependence, but the fractional Ornstein–Uhlenbeck process of the second kind exhibits a short-range dependence. This offers more opportunities to model network traffic or economic time series via tractable fractional processes. The fractional Ornstein–Uhlenbeck process of the first kind and the fractional Ornstein – Uhlenbeck process of the second kind are quite similar to simulate, since they can both be represented via stochastic differential equations.

**General information**

State: Published

Ministry of Education publication type: G4 Doctoral dissertation (monograph)

Organisations: Department of Mathematics

Authors: Kaarakka, T.

Number of pages: 102

Publication date: 6 Nov 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: 1338

ISSN (Print): 1459-2045

Electronic versions:

kaarakka_1338

Links:


**Bibliographical note**

Awarding institution:Tampere University of Technology

Versio ok 14.12.2015

Research output: Monograph › Doctoral Thesis

**Comparison Study for Whitney (Raviart-Thomas) Type Source Models in Finite Element Method Based EEG Forward Modeling**

This study concentrates on finite element method (FEM) based electroencephalography (EEG) forward simulation in which the electric potential evoked by neural activity in the brain is to be calculated at the surface of the head. The main advantage of the FEM is that it allows realistic modeling of tissue conductivity inhomogeneity. However, it is not straightforward to apply the classical model of a dipolar source with the FEM, due to its strong singularity and the resulting irregularity. The focus of this study is on comparing different methods to cope with this problem. In particular, we evaluate the accuracy of Whitney (Raviart-Thomas) type dipole-like source currents compared to two reference dipole modeling.
methods: the St. Venant and partial integration approach. Common
to all these methods is that they enable direct approximation of the
potential field utilizing linear basis functions. In the present context,
Whitney elements are particularly interesting, as they provide a simple
means to model a divergence-conforming primary current vector field
satisfying the square integrability condition. Our results show that a
Whitney type source model can provide simulation accuracy comparable
to the present reference methods. It can lead to superior accuracy under
optimized conditions with respect to both source location and orientation
in a tetrahedral mesh. For random source orientations, the St. Venant
approach turns out to be the method of choice over the interpolated
version of the Whitney model. The overall moderate differences obtained
suggest that practical aspects, such as the focality, should be prioritized
when choosing a source model.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Mathematics, Mathematical modelling with wide societal impact (MathImpact)
Authors: Pursiainen, S., Bauer, M., Vorwerk, J., Köstler, H., Wolters, C. H.
Number of pages: 9
Pages: 2648-2656
Publication date: Nov 2015
Peer-reviewed: Yes

Publication information
Journal: IEEE Transactions on Biomedical Engineering
Volume: 62
Issue number: 11
ISSN (Print): 0018-9294
Ratings:
Scopus rating (2016): CiteScore 4.2 SJR 1.214 SNIP 1.995
Scopus rating (2015): SJR 1.132 SNIP 2.083 CiteScore 3.74
Scopus rating (2014): SJR 0.84 SNIP 1.973 CiteScore 3.34
Scopus rating (2013): SJR 1.081 SNIP 2.073 CiteScore 3.53
Scopus rating (2012): SJR 0.816 SNIP 1.706 CiteScore 3
Scopus rating (2011): SJR 0.7 SNIP 1.715 CiteScore 3.04
Scopus rating (2010): SJR 0.686 SNIP 1.637
Scopus rating (2009): SJR 0.81 SNIP 1.94
Scopus rating (2008): SJR 0.826 SNIP 1.719
Scopus rating (2007): SJR 1.144 SNIP 2.187
Scopus rating (2006): SJR 1.317 SNIP 2.426
Scopus rating (2005): SJR 1.023 SNIP 2.252
Scopus rating (2004): SJR 0.73 SNIP 1.689
Scopus rating (2003): SJR 0.849 SNIP 1.367
Scopus rating (2002): SJR 0.888 SNIP 1.428
Scopus rating (2001): SJR 0.767 SNIP 1.578
Scopus rating (2000): SJR 0.942 SNIP 1.505
Scopus rating (1999): SJR 0.613 SNIP 2.187
Original language: English
DOIs: 10.1109/TBME.2015.2439282
Research output: Scientific - peer-review → Article
arvioida toisen opiskelijan tekemän tehtävän, opiskelijoiden tulee käy- dä ensin itse tehtävän ratkaisuprosessi perusteellisesti läpi, mikä mahdollisesti edesauttaa opis- keltavan asian syvempää ymmärtämistä.

Kokeilun tarkoituksena on tutkia, miten opiskelijat kokevat vertaisarvioinnin ja ennen kaikkea vaikuttaako vertaisarviointi positiivisesti heidän oppimistuloksiinsa niin arvioijana kuin arvioi- tavanakin. Esityksessä on mukana tutkimuksen alustavia tuloksia.

**General information**
State: Published
Organisations: Department of Mathematics
Number of pages: 1
Pages: 15-15
Publication date: 30 Oct 2015
Peer-reviewed: Unknown
Event: Paper presented at MATEMATIIKAN, LUONNONTIETEEN JA TEKNOLOGION OPETUKSEN TUTKIMUKSEN PÄIVÄT.
ASJC Scopus subject areas: Mathematics(all)
Additional files:
Vertaisarviointi Moodlen Työpajassa
Links:
http://users.utu.fi/haunsi/Ohjelma_ja_abstraktit.pdf

**Bibliographical note**
xpresentation
Research output: Professional › Paper, poster or abstract

**CytoSpectre: A tool for spectral analysis of oriented structures on cellular and subcellular levels**
Background: Orientation and the degree of isotropy are important in many biological systems such as the sarcomeres of cardiomyocytes and other fibrillar structures of the cytoskeleton. Image based analysis of such structures is often limited to qualitative evaluation by human experts, hampering the throughput, repeatability and reliability of the analyses. Software tools are not readily available for this purpose and the existing methods typically rely at least partly on manual operation.
Results: We developed CytoSpectre, an automated tool based on spectral analysis, allowing the quantification of orientation and also size distributions of structures in microscopy images. CytoSpectre utilizes the Fourier transform to estimate the power spectrum of an image and based on the spectrum, computes parameter values describing, among others, the mean orientation, isotropy and size of target structures. The analysis can be further tuned to focus on targets of particular size at cellular or subcellular scales. The software can be operated via a graphical user interface without any programming expertise. We analyzed the performance of CytoSpectre by extensive simulations using artificial images, by benchmarking against FibrilTool and by comparisons with manual measurements performed for real images by a panel of human experts. The software was found to be tolerant against noise and blurring and superior to FibrilTool when analyzing realistic targets with degraded image quality. The analysis of real images indicated general good agreement between computational and manual results while also revealing notable expert-to-expert variation. Moreover, the experiment showed that CytoSpectre can handle images obtained of different cell types using different microscopy techniques. Finally, we studied the effect of mechanical stretching on cardiomyocytes to demonstrate the software in an actual experiment and observed changes in cellular orientation in response to stretching.
Conclusions: CytoSpectre, a versatile, easy-to-use software tool for spectral analysis of microscopy images was developed. The tool is compatible with most 2D images and can be used to analyze targets at different scales. We expect the tool to be useful in diverse applications dealing with structures whose orientation and size distributions are of interest. While designed for the biological field, the software could also be useful in non-biological applications.
A NLOS-robust TOA positioning filter based on a skew-t measurement noise model

A skew-t variational Bayes filter (STVBF) is applied to indoor positioning with time-of-arrival (TOA) based distance measurements and pedestrian dead reckoning (PDR). The proposed filter accommodates large positive outliers caused by occasional non-line-of-sight (NLOS) conditions by using a skew-t model of measurement errors. Real-data tests using the fusion of inertial sensors based PDR and ultra-wideband based TOA ranging show that the STVBF clearly outperforms the extended Kalman filter (EKF) in positioning accuracy with the computational complexity about three times that of the EKF.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Automation Science and Engineering, Research group: Positioning, Wireless Communications and Positioning (WICO)
Authors: Nurminen, H., Ardeshiri, T., Piche, R., Gustafsson, F.
Number of pages: 7
Pages: 1-7
Publication date: 1 Oct 2015

Host publication information
Title of host publication: 2015 International Conference on Indoor Positioning and Indoor Navigation (IPIN)
Publisher: IEEE
Keywords: Approximation methods, Computational modeling, Distance measurement, Gaussian distribution, Measurement errors, Noise measurement, Position measurement, NLOS, TOA, UWB, indoor positioning, robust filtering, skew t, skewness, variational Bayes
Polynomial Input-Output Stability for Linear Systems

We introduce the concept of polynomial input-output stability for infinite-dimensional linear systems. We show that this stability type corresponds exactly to the recent notion of P-stability in the frequency domain. In addition, we show that on a Hilbert space a regular linear system whose system operator generates a polynomially stable semigroup is always polynomially input-output stable, and present additional conditions under which the system is input-output stable. The results are illustrated with an example of a polynomially input-output stable one-dimensional wave system.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Mathematics, Research group: MAT Mathematical and semantic modelling
Authors: Paunonen, L., Laakkonen, P.
Number of pages: 6
Pages: 2797-2802
Publication date: 1 Oct 2015
Peer-reviewed: Yes

Publication information
Journal: IEEE Transactions on Automatic Control
Volume: 60
Issue number: 10
ISSN (Print): 0018-9286
Ratings:
Scopus rating (2016): CiteScore 6.06 SJR 4.174 SNIP 3.159
Scopus rating (2015): SJR 3.926 SNIP 2.884 CiteScore 5.08
Scopus rating (2014): SJR 4.196 SNIP 3.347 CiteScore 5.14
Scopus rating (2013): SJR 4.096 SNIP 3.13 CiteScore 5.24
Scopus rating (2012): SJR 4.143 SNIP 3.292 CiteScore 5.11
Scopus rating (2011): SJR 3.749 SNIP 2.961 CiteScore 4.11
Scopus rating (2010): SJR 2.939 SNIP 2.917
Scopus rating (2009): SJR 3.945 SNIP 3.449
Scopus rating (2006): SJR 3.67 SNIP 2.917
Scopus rating (2005): SJR 1.968 SNIP 2.566
Scopus rating (2004): SJR 2.959 SNIP 2.708
Scopus rating (2003): SJR 3.359 SNIP 2.589
Scopus rating (2002): SJR 3.982 SNIP 2.349
Scopus rating (2001): SJR 4.161 SNIP 2.777
Scopus rating (2000): SJR 3.887 SNIP 2.772
Scopus rating (1999): SJR 1.93 SNIP 2.438
Original language: English
Keywords: Distributed parameter system, Stability
ASJC Scopus subject areas: Electrical and Electronic Engineering, Control and Systems Engineering, Computer Science Applications

DOIs:
10.1109/TAC.2015.2398890
Links:
http://www.scopus.com/inward/record.url?scp=84942853446&partnerID=8YFLogxK (Link to publication in Scopus)
We use the recently released Atacama Large Millimeter Array (ALMA) and VLT/SPHERE science verification data, together with earlier adaptive-optics images, stellar occultation, and lightcurve data to model the 3D shape and spin of the large asteroid (3) Juno with the all-data asteroid modelling (ADAM) procedure. These data set limits on the plausible range of shape models, yielding reconstructions suggesting that, despite its large size, Juno has sizable unrounded features moulded by non-gravitational processes such as impacts.
Modelling and control of vertical oscillation in overhead cranes

Overhead cranes are widely used in industry for lifting and moving various loads. Right before lifting a heavy load from the ground the crane bridge slightly bends, which makes the load oscillate vertically during the lifting. Vertical oscillations may introduce unnecessary stress to the crane metal structures and hoisting machinery, and thus reduce the lifetime of the crane. Furthermore, vertical oscillations make the load handling and positioning more difficult, thus decreasing the performance of operations. Nevertheless, study of vertical oscillations in overhead cranes has been neglected in literature. In this paper, a model for analyzing vertical oscillations and for control design is developed. Oscillation control, based on rope force measurement, is developed to decrease maximal forces and to reduce the time of oscillation. The resulting controller is tested with a real overhead crane having nominal load of five tons.

From artificial cognitive systems and open architectures to cognitive manufacturing systems

Considering constantly increasing demand for shift from mass production to mass customization and the need to maintain high level of automation despite permanent changes in manufacturing technologies and tools new approaches and solutions have to be provided in manufacturing. Cyber-Physical Systems and Industrial Internet of Things are enabling smart manufacturing to tackle the challenge of data processing, integration and interpretation, but beyond uniformed data collection and visualization. The cognitive approach is argued to introduce brain and biologically-inspired algorithms capable to better adapt industrial systems for unforeseen conditions. Such approach should provide flexible and robust solution for manufacturing systems, enabling new level of adaptability and re-configurability in the system by self-X capabilities. In this paper contemporary solutions applicable for introduction of cognitive capabilities in manufacturing systems are studied and the architecture for cognitive manufacturing system employing benefits of Industrial Internet and Cognitive Control is proposed.
Received Signal Strength models for WLAN and BLE-based indoor positioning in multi-floor buildings

This paper investigates the similarities and differences of the signal strength fluctuations and positioning accuracy in indoor scenarios for three types of wireless area networks: two Wireless Local Area Networks (WLANs) at 2.4 GHz and 5 GHz frequency, respectively, and one Wireless Personal Area Network (WPAN), namely the Bluetooth Low Energy (BLE). Two path-loss models based on weighted centroids and non-negative least squares estimation are presented: one including a floor loss factor, and the other one ignoring the floor losses, and the three signal types are compared in terms of the path-loss parameters, channel fluctuations and positioning accuracy, namely the distance errors and floor detection probabilities. The comparison is done based on real-field measurement data collected from a university building in Tampere, Finland. It is shown that all these three signal types have similar shadowing variances and close path-loss parameter values, and that a path-loss model considering floor losses gives the best floor detection probability, but not necessarily the smallest distance error.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Authors: Lohan, E., Talvitie, J., Figueiredo e Silva, P., Nurminen, H., Ali-Löytty, S., Piche, R.
Number of pages: 6
Publication date: 23 Jun 2015

Host publication information
Title of host publication: International Conference on Localization and GNSS (ICL-GNSS)
Publisher: IEEE
ISBN (Print): 9781479998593
Electronic versions:
BLE_WLAN_v05camready_emb
DOIs:
10.1109/ICL-GNSS.2015.7217154
Links:
http://urn.fi/URN:NBN:fi:ttly-201603013609

Visual tools to support innovation development: User experiences from the Parisian ecosystem
Purpose – This paper reports an experimental application of network visualization to understand the value of visual expression for presenting complex knowledge assets to executive decision makers in order to develop culturally-relevant insights for program development.

Design/methodology/approach – In pairs, decision makers used interactive network visualizations to explore complex multi-layer data about relationships among key executives, companies, and financing organizations in the region served by their network facilitation programs. Their experiences were documented using pre- and post- questionnaires, as well as observations and interviews conducted by research team members.

Originality/value – The results provide novel evidence of the benefits of a relationship- based visual format to present knowledge assets for evidence-based decisions. Using interactive visualizations, the decision makers aligned views of the data with their individual cognitive mindsets. Working in pairs to complete a joint task, team members made their cultural interpretation and working explicit.

Practical implications – The findings support the argument that the value of knowledge assets in problem-solving performance depends on both the format of the data and the nature of the task. Our results support the importance of continual involvement and interaction between data analysts and decision makers; they highlight the importance of considering knowledge assets as value drivers that can support knowledge-based innovation.
Gaussian filtering and variational approximations for Bayesian smoothing in continuous-discrete stochastic dynamic systems

The Bayesian smoothing equations are generally intractable for systems described by nonlinear stochastic differential equations and discrete-time measurements. Gaussian approximations are a computationally efficient way to approximate the true smoothing distribution. In this work, we present a comparison between two Gaussian approximation methods. The Gaussian filtering based Gaussian smoother uses a Gaussian approximation for the filtering distribution to form an approximation for the smoothing distribution. The variational Gaussian smoother is based on minimizing the Kullback-Leibler divergence of the approximate smoothing distribution with respect to the true distribution. The results suggest that for highly nonlinear systems, the variational Gaussian smoother can be used to iteratively improve the Gaussian filtering based smoothing solution. We also present linearization and sigma-point methods to approximate the intractable Gaussian expectations in the variational Gaussian smoothing equations. In addition, we extend the variational Gaussian smoother for certain class of systems with singular diffusion matrix.
Fundamental solution of k-hyperbolic harmonic functions in odd spaces
We study k-hyperbolic harmonic functions in the upper half space. The operator is the Laplace-Beltrami operator with respect to the Riemannian metric. In case $k = n - 1$ the Riemannian metric is the hyperbolic distance of Poincare upper half space. The proposed functions are connected to the axially symmetric potentials studied notably by Weinstein, Huber and Leutwiler. We present the fundamental solution in case $n$ is even using the hyperbolic metric. The main tool is the transformation of k-hyperbolic harmonic functions to eigenfunctions of the hyperbolic Laplace operator.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Mathematics, Research group: MAT Clifford analysis
Authors: Eriksson, S., Orelma, H.
Publication date: 13 Apr 2015
Peer-reviewed: Yes

Publication information
Journal: Journal of Physics: Conference Series
Volume: 597
Issue number: 1
Article number: 012034
ISSN (Print): 1742-6596
Ratings:
Scopus rating (2016): CiteScore 0.45 SJR 0.24 SNIP 0.383
Scopus rating (2015): SJR 0.24 SNIP 0.373 CiteScore 0.35
Scopus rating (2014): SJR 0.253 SNIP 0.344 CiteScore 0.32
Scopus rating (2013): SJR 0.231 SNIP 0.272 CiteScore 0.25
Scopus rating (2012): SJR 0.28 SNIP 0.354 CiteScore 0.33
Scopus rating (2011): SJR 0.292 SNIP 0.352 CiteScore 0.43
Scopus rating (2010): SJR 0.288 SNIP 0.344
Scopus rating (2009): SJR 0.253 SNIP 0.321
Scopus rating (2008): SJR 0.265 SNIP 0.294
Scopus rating (2007): SJR 0.257 SNIP 0.39
Scopus rating (2006): SJR 0.267 SNIP 0.284
Original language: English
ASJC Scopus subject areas: Physics and Astronomy(all)
DOIs:
10.1088/1742-6596/597/1/012034
Links:
http://www.scopus.com/inward/record.url?scp=84928019119&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source-ID: 84928019119
Research output: Scientific - peer-review › Article

ADAM: A general method for using various data types in asteroid reconstruction
We introduce ADAM, the All-Data Asteroid Modelling algorithm. ADAM is simple and universal since it handles all disk-resolved data types (adaptive optics or other images, interferometry, and range-Doppler radar data) in a uniform manner via the 2D Fourier transform, enabling fast convergence in model optimization. The resolved data can be combined with disk-integrated data (photometry). In the reconstruction process, the difference between each data type is only a few code lines defining the particular generalized projection from 3D onto a 2D image plane. Occultation timings can be included as
sparse silhouettes, and thermal infrared data are efficiently handled with an approximate algorithm that is sufficient in practice because of the dominance of the high-contrast (boundary) pixels over the low-contrast (interior) pixels. This is of particular importance to the raw ALMA data that can be directly handled by ADAM without having to construct the standard image. We study the reliability of the inversion, using the independent shape supports of function series and control-point surfaces. When other data are lacking, one can carry out fast non-convex lightcurve-only inversions, but any shape models resulting from it should only be taken as illustrative large-scale models.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Mathematics, Research group: MAT Inverse Problems, Mathematical modelling with wide societal impact (MathImpact), Astronomical Institute, Faculty of Mathematics and Physics, Charles University in Prague
Authors: Viikinkoski, M., Kaasalainen, M., Durech, J.
Number of pages: 11
Publication date: 1 Apr 2015
Peer-reviewed: Yes

Publication information
Journal: Astronomy and Astrophysics
Volume: 576
Article number: A8
ISSN (Print): 0004-6361
Ratings:
Scopus rating (2016): CiteScore 3.68 SJR 2.246 SNIP 1.16
Scopus rating (2015): SJR 2.543 SNIP 1.189 CiteScore 3.5
Scopus rating (2014): SJR 2.823 SNIP 1.219 CiteScore 2.82
Scopus rating (2013): SJR 2.544 SNIP 1.058 CiteScore 2.01
Scopus rating (2012): SJR 2.585 SNIP 1.295 CiteScore 3.14
Scopus rating (2011): SJR 2.373 SNIP 1.231 CiteScore 3.42
Scopus rating (2010): SJR 2.74 SNIP 1.444
Scopus rating (2009): SJR 2.879 SNIP 1.404
Scopus rating (2008): SJR 2.923 SNIP 1.297
Scopus rating (2007): SJR 2.816 SNIP 1.34
Scopus rating (2006): SJR 3.224 SNIP 1.349
Scopus rating (2005): SJR 2.891 SNIP 1.355
Scopus rating (2004): SJR 2.633 SNIP 1.462
Scopus rating (2003): SJR 1.967 SNIP 1.373
Scopus rating (2002): SJR 1.742 SNIP 1.346
Scopus rating (2001): SJR 1.555 SNIP 0.727
Scopus rating (2000): SJR 2.178 SNIP 1.039
Scopus rating (1999): SJR 2.489 SNIP 1.076
Original language: English
ASJC Scopus subject areas: Astronomy and Astrophysics, Space and Planetary Science
Keywords: Methods: analytical, Methods: numerical, Minor planets, asteroids: general, Minor planets, asteroids: individual: 2000 ET70, Minor planets, asteroids: individual: Daphne
Electronic versions:
ADAM
DOIs:
10.1051/0004-6361/201425259
Links:
Source: Scopus
Source-ID: 84925251323
Research output: Scientific - peer-review › Article

On improvement of transient stage of composite nonlinear feedback control using arbitrary order set point filters
This paper studies the generalization of composite nonlinear feedback (CNF) control using arbitrary order set point filters, which focus on the initial stage of the transient response. The set point filters can be used to provide more performance by shortening the rise and settling times of the control system. Furthermore, the filters operate outside the feedback loop, and
hence, they do not sacrifice loop robustness. The new method is illustrated by a benchmark problem found in an open literature. The simulation results show that the proposed method improves the set point response more than 10% in terms of settling time.

**General information**
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Authors: Pyrhönen, V., Koivisto, H.
Number of pages: 6
Pages: 147 - 152
Publication date: 1 Apr 2015

**Host publication information**
Title of host publication: 2014 IEEE International Conference on Control System, Computing and Engineering (ICCSCE)
Publisher: Institute of Electrical and Electronics Engineers IEEE
ISBN (Print): 978-1-4799-5685-2
Keywords: Composite nonlinear feedback, actuator saturation, high performance, robust control, set point filter, control system synthesis, feedback, nonlinear control systems, transient response
DOI:
10.1109/ICCSCE.2014.7072705
Links:
http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=7072705
Research output: Scientific - peer-review › Conference contribution

**Composite Nonlinear Feedback Control of a Chemical Reactor**
This paper studies the application of composite nonlinear feedback (CNF) control for a continuous time stirred tank reactor. Inside the reactor, an exothermic chemical reaction occurs, which requires cooling when concentration is commanded from low to high conversion rate to prevent a thermal runaway. A full-state CNF controller is designed for adjusting the temperature of the cooling jacket using concentration and temperature measurements. A continuous time gain-scheduled cascade controller, as well as a model predictive controller (MPC) is also fabricated for comparison. The gain-scheduled cascade controller has a proportional-integral (PI) controller as a primary loop controller, and a P-controller as a secondary loop controller. The simulation results show that the CNF controller is able to offer the best overall tracking performance as measured by the integral-of-absolute-error (IAE) criterion. In addition, the CNF controller does not need gain-scheduling for tuning purposes; the CNF controller is capable of changing its tuning as a function of control error only.

**General information**
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Research area: Information Systems in Automation, Research area: Dynamic Systems, Department of Automation Science and Engineering
Authors: Pyrhönen, V., Koivisto, H.
Publication date: 18 Mar 2015

**Host publication information**
Title of host publication: Proceedings of AutomaatioXXI, The Industrial Revolution of Internet – From Intelligent Devices to Networked Intelligence
Place of publication: Helsinki, Finland
Publisher: Suomen Automaatioseura ry

**Publication series**
Name: SAS julkaisusarja
Publisher: Finnish Society of Automation
Volume: 44
Keywords: exothermic reaction, nonlinear control, nonlinear dynamics, cascade control
Research output: Scientific - peer-review › Conference contribution

**Projektioppiminen: lähtökohtana ympäröivä maailma**
Oppilaat tarvitsevat matematiikkaa arjessa ja tulevassa työelämässä, ei vain matematiikan tunneilla. Projektioppiminen-kehittämisohjekseen tarkoituksena on lisätä yläkouluikäisten oppilaiden motivaatiota matematiikkaa kohtaan ja luoda samalla matematiikkinosstausta.

**General information**
We present how the education of subject teachers is organized in mathematics, science and computer science in Tampere. It is based on the idea that both engineering students and students from mathematics and science may choose to become a subject teacher. Students are accepted either to the master’s degree program in Science and Engineering of Tampere University of Technology or the master’s program of Mathematics and Statistics of University of Tampere. Students from different universities are giving opportunities to learn from each other. They study physics and chemistry in Tampere University of Technology and do pedagogical studies in University of Tampere. Both universities have also developed special motivating courses based on the didactical research to their students. In mathematics, there is a joined course for the second or third year students motivating towards teaching carrier. In both universities there are possibilities to do the master or bachelor thesis in didactics of mathematics or science. Both universities have an important role in education of subject teachers in Finland. Tampere University of Technology is providing opportunities during studies to cooperate between schools and industry. It gives ideas how science and mathematics are applied in the modern society. University of Tampere also trains primary school teachers with specialization in mathematics.

Generalized hyperbolic harmonic functions in the plane
We consider solutions of the equation \(y\Delta h(x,y)-k ah/ay=0\) in the plane. These functions already have been investigated by Weinstein around 1950 in connection of generalized axially symmetric potential theory. We have found several results concerning these type of functions, called k-hyperbolic harmonic functions, in higher dimensions. In this paper, we show in the plane case that it is possible to compute the explicit fundamental solutions in terms of the hyperbolic metric. These results may be used to find fundamental solutions in all even dimensional spaces. The key tools are the transformation properties of hyperbolic metric of the Poincaré upper half space model.
Multi-stable dynamics of the non-adiabatic repressilator
The assumption of the fast binding of transcription factors (TFs) to promoters is a typical point in studies of synthetic genetic circuits functioning in bacteria. Although the assumption is effective for simplifying the models, it becomes questionable in the light of in vivo measurements of the times TF spends searching for its cognate DNA sites. We investigated the dynamics of the full idealized model of the paradigmatic genetic oscillator, the repressilator, using deterministic mathematical modelling and stochastic simulations. We found (using experimentally approved parameter values) that decreases in the TF binding rate changes the type of transition between steady state and oscillation. As a result, this gives rise to the hysteresis region in the parameter space, where both the steady state and the oscillation coexist. We further show that the hysteresis is persistent over a considerable range of the parameter values, but the presence of the oscillations is limited by the low rate of TF dimer degradation. Finally, the stochastic simulation of the model confirms the hysteresis with switching between the two attractors, resulting in highly skewed period distributions. Moreover, intrinsic noise stipulates trains of large-amplitude modulations around the stable steady state outside the hysteresis region, which makes the period distributions bimodal.
Designing controllers with reduced order internal models

In this technical note we study robust output tracking for autonomous linear systems. We introduce a new approach to designing robust controllers using a recent observation that a full internal model is not always necessary for robustness. Especially this may be the case if the control law is only required to be robust with respect to a specific predetermined class of uncertainties in the parameters of the plant. The results are illustrated with an example on robust output tracking for coupled harmonic oscillators.
Semantic Labeling of Places based on Phone Usage Features using Supervised Learning

Nowadays mobile applications demand higher context awareness. The applications aim to understand the user's context (e.g., home or at work) and provide services tailored to the users. The algorithms responsible for inferring the user's context are the so-called context inference algorithms, the place detection being a particular case. Our hypothesis is that people use mobile phones differently when they are located in different places (e.g., longer calls at home than at work). Therefore, the usage of the mobile phones could be an indicator of the users' current context. The objective of the work is to develop a system that can estimate the user's place label (home, work, etc.), based on phone usage. As training and validation set, we use a database containing phone usage information of 200 users over several months including phone call and SMS logs, multimedia usage, accelerometer, GPS, network information and system information. The data was split into visits, i.e., periods of uninterrupted time that the user has been in a certain place (Home, Work, Leisure, etc.). The data include information about the phone usage during the visits, and the semantic label of the place visited (Home, Work, etc.). We consider two approaches to represent this data: the first approach (so-called visits approach) saves each visit separately; the second approach (so-called places approach) combines all visits of one user to a certain place and creates place-specific information. For place detection, we used five popular classification methods, Naïve Bayes, Decision Tree, Bagged Tree, Neural Network and K-Nearest Neighbors, in both representation approaches. We evaluated their classification rates and found that: 1) Bagged Tree outperforms the other methods; 2) the places data-representation gives better results than the visits data-representation.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Mathematics, Research group: MAT Intelligent Information Systems Laboratory, Department of Automation Science and Engineering, Research area: Dynamic Systems, Research group: Positioning, Wireless Communications and Positioning (WICO)
Authors: Rivero Rodriguez, A., Leppäkoski, H., Piché, R.
Number of pages: 6
Pages: 97-102
Publication date: 5 Feb 2015

Host publication information
Title of host publication: 2014 Ubiquitous Positioning Indoor Navigation and Location Based Service, UPINLBS 2014 - Conference Proceedings
Place of publication: Piscataway, NJ, USA
Publisher: IEEE
Article number: 7033715
ISBN (Print): 9781479960040
Keywords: Context Inference, Location and positioning services, Place detection, Semantic positioning
ASJC Scopus subject areas: Computer Networks and Communications, Computer Science Applications
Electronic versions:
Context-Inference
DOI: 10.1109/UPINLBS.2014.7033715
Links:
http://urn.fi/URN:NBN:fi:tty-201603013584

Bibliographical note
ORG=mat,0.6
ORG=ase,0.4

Portfolio EDEND: 2015-01-14 <br /> publication_forum:72750
Source: researchoutputwizard
Source-ID: 30
Research output: Scientific - peer-review › Conference contribution

A general framework for island systems
The notion of an island defined on a rectangular board is an elementary combinatorial concept that occurred first in [3]. Results of [3] were starting points for investigations exploring several variations and various aspects of this notion. In this paper we introduce a general framework for islands that subsumes all earlier studied concepts of islands on finite boards, moreover we show that the prime implicants of a Boolean function, the formal concepts of a formal context, convex subgraphs of a simple graph, and some particular subsets of a projective plane also fit into this framework. We axiomatize
those cases where islands have the property of being pairwise comparable or disjoint, or they are distant, introducing the
notion of a connective island domain and of a proximity domain, respectively. In the general case the maximal systems of
islands are characterised by using the concept of an admissible system. We also characterise all possible island systems
in the case of connective island domains and proximity domains.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Mathematics, Bolyai Institute, University of Szeged, University of Miskolc
Authors: Foldes, S., Horváth, E. K., Radeleczki, S., Waldhauser, T.
Number of pages: 22
Pages: 3-24
Publication date: 2015
Peer-reviewed: Yes

Publication information
Journal: Acta Universitatis Szegedensis: Acta Scientiarum Mathematicarum
Volume: 81
Issue number: 1-2
ISSN (Print): 0001-6969
Ratings:
Scopus rating (2016): SJR 0.396 SNIP 0.639 CiteScore 0.35
Scopus rating (2015): SJR 0.309 SNIP 0.738 CiteScore 0.34
Scopus rating (2014): SJR 0.283 SNIP 0.472 CiteScore 0.28
Scopus rating (2013): SJR 0.431 SNIP 0.653 CiteScore 0.42
Scopus rating (2012): SJR 0.26 SNIP 0.52 CiteScore 0.31
Scopus rating (2011): SJR 0.315 SNIP 0.513 CiteScore 0.29
Scopus rating (2010): SJR 0.315 SNIP 0.685
Scopus rating (2009): SJR 0.122 SNIP 0
Scopus rating (2008): SJR 0.122 SNIP 0
Scopus rating (2007): SJR 0.122 SNIP 0
Original language: English
Keywords: Admissible system, CD-independent and CDW-independent sets, Connected subgraph, Convex subgraph,
Distant system, Formal concept, Height function, Island domain, Island system, Point-to-set proximity relation, Prime
implicant, Projective plane, Proximity domain
ASJC Scopus subject areas: Analysis, Applied Mathematics
DOIs:
10.14232/actasm-013-279-7
Links:
http://www.scopus.com/inward/record.url?scp=84938827353&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source-ID: 84938827353
Research output: Scientific - peer-review › Article

A model based analysis of the measurement errors in inductively coupled passive resonance sensors
A lumped element model was used to predict the measurement results of an inductively coupled resonance sensor. Errors
related to the inductive coupling and the reader coil self-resonance were studied. The model was compared with
measurements made with a physical circuit.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Automation Science and Engineering, Research area: Microsystems, Research area:
Measurement Technology and Process Control, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Salpavaara, T., Lekkala, J.
Number of pages: 4
Publication date: 2015

Host publication information
Title of host publication: IMEKO XXI World Congress, Proceedings, August 30 - September 4, 2015, Prague, Czech
Republic
Editor: Holub, J.
ISBN (Print): 978-80-01-05793-3
Analysis of geometric primitives in quantitative structure models of tree stems

One way to model a tree is to use a collection of geometric primitives to represent the surface and topology of the stem and branches of a tree. The circular cylinder is often used as the geometric primitive, but it is not the only possible choice. We investigate various geometric primitives and modelling schemes, discuss their properties and give practical estimates for expected modelling errors associated with the primitives. We find that the circular cylinder is the most robust primitive in the sense of a well-bounded volumetric modelling error, even with noise and gaps in the data. Its use does not cause errors significantly larger than those with more complex primitives, while the latter are much more sensitive to data quality. However, in some cases, a hybrid approach with more complex primitives for the stem is useful.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Mathematics, Research group: MAT Inverse Problems, Mathematical modelling with wide societal impact (MathImpact), Centre for Sustainable Forestry and Climate Change, Forest Research
Authors: Åkerblom, M., Raumonen, P., Kaasalainen, M., Casella, E.
Number of pages: 23
Pages: 4581-4603
Publication date: 2015
Peer-reviewed: Yes

Publication information
Journal: Remote Sensing
Volume: 7
Issue number: 4
ISSN (Print): 2072-4292
Ratings:
Scopus rating (2016): CiteScore 3.56 SJR 1.31 SNIP 1.661
Scopus rating (2015): SJR 1.339 SNIP 1.691 CiteScore 3.76
Scopus rating (2014): SJR 1.28 SNIP 1.886 CiteScore 3.23
Scopus rating (2013): SJR 1.167 SNIP 1.981 CiteScore 3.01
Scopus rating (2012): SJR 0.999 SNIP 1.645 CiteScore 2.36
Scopus rating (2011): SJR 0.498 SNIP 1.268 CiteScore 1.3
Scopus rating (2010): SJR 0.315 SNIP 0.531
Original language: English
Keywords: Biomass estimation, Error analysis, Shape fitting, Terrestrial laser scanning, Tree modelling
ASJC Scopus subject areas: Earth and Planetary Sciences(all)
DOIs: 10.3390/rs70404581
Links:
http://www.scopus.com/inward/record.url?scp=84937899906&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source-ID: 84937899906
Research output: Scientific - peer-review › Article

An Initial Homophily Indicator to Reinforce Context-Aware Semantic Computing

The vast increase of personal sensor information is driving the rise in popularity of context-aware applications. Users crave and very often expect tailored services that are based on the users’ context or personal preferences. The users themselves, using forms, often provide such information. An inference solution typically addresses this problem. In this paper, we present and show by way of a real-world example, the first step towards incorporating information of the user’s social networking behavior in the inference task. We define an initial indicator of a particular social phenomenon, called Homophily, and describe how the indicator measures the presence of homophily at certain moments, also capturing the degree to which it is present. Different from existing indicators, ours lends itself to indicating the presence of homophily in a way that is easier to comprehend, so that it may be easily integrated into and reinforce context-aware semantic computing.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Mathematics, Research group: MAT Intelligent Information Systems Laboratory
Authors: Rivero-Rodriguez, A., Pileggi, P., Nykänen, O.
Crowdfunding via the internet is a relatively new phenomenon in research and gaining momentum currently. While taking a data-driven approach into investigating the properties and dynamics of crowdfunding campaigns would allow the use of computational social science in investigations on crowdfunding, existing data-driven research on crowdfunding remains very limited. This is particularly true on the level of individual funder data. In this study, we contribute to the empirical body of knowledge on crowdfunding by introducing Indiegogo as a data source and, more specifically, the development and implementation of a crawler and scraper for accessing Indiegogo campaign data, and sharing this openly for other researchers. Due to the extremely dynamic and rapidly increasing amount of crowdfunding data in terms of the number of crowdfunding campaigns and the available investment and individual investor data, we believe our approach is useful for supporting public and open data-driven research, instead of providing merely a static data set.

Assessing coupling dynamics from an ensemble of time series
Finding interdependency relations between time series provides valuable knowledge about the processes that generated the signals. Information theory sets a natural framework for important classes of statistical dependencies. However, a reliable estimation from information-theoretic functionals is hampered when the dependency to be assessed is brief or evolves in time. Here, we show that these limitations can be partly alleviated when we have access to an ensemble of
independent repetitions of the time series. In particular, we gear a data-efficient estimator of probability densities to make use of the full structure of trial-based measures. By doing so, we can obtain time-resolved estimates for a family of entropy combinations (including mutual information, transfer entropy and their conditional counterparts), which are more accurate than the simple average of individual estimates over trials. We show with simulated and real data generated by coupled electronic circuits that the proposed approach allows one to recover the time-resolved dynamics of the coupling between different subsystems.

**General information**

State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Mathematics, University of Electronic Science and Technology of China, Institute of Computer Science (ICS) of the Foundation for Research and Technology - Hellas (FORTH), Lab of Neurophysics and Neurophysiology, Hefei National Laboratory for Physical Sciences at the Microscale, Instituto de Física Interdisciplinar y Sistemas Complejos (CSIC-UIB), Campus Universitat de les Illes Balears, Institut für Kognitionswissenschaft, University of Osnabrück, University of Tartu, Netherlands Institute for Neuroscience
Authors: Gómez-Herrero, G., Wu, W., Rutanen, K., Soriano, M. C., Pipa, G., Vicente, R.
Number of pages: 13
Pages: 1958-1970
Publication date: 2015
Peer-reviewed: Yes

**Publication information**

Journal: Entropy
Volume: 17
Issue number: 4
ISSN (Print): 1099-4300
Ratings:
Scopus rating (2016): CiteScore 1.87 SJR 0.584 SNIP 1.065
Scopus rating (2015): SJR 0.557 SNIP 1.166 CiteScore 1.99
Scopus rating (2014): SJR 0.51 SNIP 1.169 CiteScore 1.69
Scopus rating (2013): SJR 0.488 SNIP 1.347 CiteScore 1.8
Scopus rating (2012): SJR 0.409 SNIP 1.04 CiteScore 1.41
Scopus rating (2011): SJR 0.47 SNIP 1.109 CiteScore 1.29
Scopus rating (2010): SJR 0.394 SNIP 1.056
Scopus rating (2009): SJR 0.358 SNIP 0.612
Scopus rating (2008): SJR 0.325 SNIP 0.604
Scopus rating (2007): SJR 0.574 SNIP 0.925
Scopus rating (2006): SJR 0.35 SNIP 0.644
Scopus rating (2005): SJR 0.299 SNIP 0.382
Scopus rating (2004): SJR 0.244 SNIP 0.543
Scopus rating (2003): SJR 0.209 SNIP 0.351
Scopus rating (2002): SJR 0.178 SNIP 0.461
Scopus rating (2001): SJR 0.12 SNIP 0.292
Scopus rating (2000): SJR 0.141 SNIP 2.3
Original language: English
Keywords: Ensemble, Entropy, Estimator, Time series, Transfer entropy, Trial
ASJC Scopus subject areas: Physics and Astronomy(all)
DOIs:
10.3390/e17041958
Links:
http://www.scopus.com/inward/record.url?scp=84930319366&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source-ID: 84930319366
Research output: Scientific - peer-review › Article

**Asteroid Models from Multiple Data Sources**

**General information**

State: Published
Ministry of Education publication type: A3 Part of a book or another research book
Organisations: Department of Mathematics, Research group: MAT Inverse Problems
Engineering motif search for large graphs

In the graph motif problem, we are given as input a vertex-colored graph H (the host graph) and a multiset of colors M (the motif). Our task is to decide whether H has a connected set of vertices whose multiset of colors agrees with M. The graph motif problem is NP-complete but known to admit parameterized algorithms that run in linear time in the size of H. We demonstrate that algorithms based on constrained multilinear sieving are viable in practice, scaling to graphs with hundreds of millions of edges as long as M remains small. Furthermore, our implementation is topology-invariant relative to the host graph H, meaning only the most crude graph parameters (number of edges and number of vertices) suffice in practice to determine the algorithm performance.

Equal Opportunities in Education of Science, Mathematics and Technology

We are raising a question if our education system in Finland is still providing equal opportunities for everybody in education of Science and Mathematics and Technology. We are using as indicators recent results of three international assessments: The Program for International Student Assessment, Trends in International Mathematics and Science Study and The learning curve in Science and Mathematics. There are a lot of research done internationally and nationally based on the results of these assessments and the background information connected to them. These assessments have also started rich discussions in news and in newspapers.

Basic Education Act 1998 in Finland gives every child a right to go to the close by neighborhood school, assigned by the local school authorities, and parents a freedom to choose some another school for their child. In addition, some local schools have a right to emphasize certain areas of education and to choose their students based on suitability tests. Connected to these issues, we are describing some research results concerning the status of schools and selection of
This paper deals with frequency domain robust regulation of signals generated by an infinite-dimensional exosystem. The problem is formulated and the stability types are chosen so that one can generalize the existing finite-dimensional theory to more general classes of infinite-dimensional systems and signals. The main results of this article are extensions of the internal model principle, of a necessary and sufficient solvability condition for the robust regulation problem, and of Davison's simple servo compensator for stable plants in the chosen algebraic framework.
GNSS orbit prediction with enhanced force model
Orbit prediction algorithms can be used in a portable positioning device to reduce the Time to First Fix and to augment the received broadcast ephemeris. In this work, we study the two-week prediction accuracy improvement that can be obtained when adding some smaller forces to our previously developed algorithm. These forces arise from solid earth tides, relativity effect, and the gravitational pull of Venus and Jupiter. Also, a box-wing model of solar radiation pressure is considered. The new model with aforementioned extra forces is tested for GPS, GLONASS and Beidou satellites using initial conditions computed from precise ephemerides. It is found that the enhancements give small but not negligible improvement, with more accurate Sun and Moon coordinates having the most effect and relativity correction for Earth's gravity the least. However, the improvements come at the cost of noticeable increase in computational load.

Infinitesimals and Pavelka logic
Rational Pavelka Logic does not admit infinitesimals. We argue that infinitesimals are important in logic and we present an alternative approach which admits them. It is built up in a similar style, but based on the Chang's perfect MV-algebra. We prove a partial result towards the completeness of this logic. We also discuss a combined approach using more complex perfect MV-algebras.
Massive-Scale Tree Modelling from TLS Data

This paper presents a method for reconstructing automatically the quantitative structure model of every tree in a forest plot from terrestrial laser scanner data. A new feature is the automatic extraction of individual trees from the point cloud. The method is tested with a 30-m diameter English oak plot and a 80-m diameter Australian eucalyptus plot. For the oak plot the total biomass was overestimated by about 17 %, when compared to allometry (N = 15), and the modelling time was about 100 min with a laptop. For the eucalyptus plot the total biomass was overestimated by about 8.5 %, when compared to a destructive reference (N = 27), and the modelling time was about 160 min. The method provides accurate and fast tree modelling abilities for, e. g., biomass estimation and ground truth data for airborne measurements at a massive ground scale.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Mathematics, Research group: MAT Inverse Problems, Forest Res, Wageningen Univ, Wageningen University & Research Center, Univ Melbourne, University of Melbourne, Melbourne Sch Land & Environm
Authors: Raumonen, P., Casella, E., Calders, K., Murphy, S., Åkerblom, M., Kaasalainen, M.
Number of pages: 8
Pages: 189-196
Publication date: 2015

Host publication information
Title of host publication: ISPRS Annals of the Photogrammetry, Remote Sensing and Spatial Information Sciences
Volume: II-3/W4
Place of publication: GOTTINGEN
Publisher: COPERNICUS GESELLSCHAFT MBH
Editors: Stilla, U., Heipke, C.

Publication series
Name: International Archives of the Photogrammetry Remote Sensing and Spatial Information Sciences
Publisher: COPERNICUS GESELLSCHAFT MBH
Volume: 43
ISSN (Print): 2194-9034
Keywords: quantitative structure model, automatic tree extraction, biomass, forest plot, ground truth, oak, eucalyptus, LiDAR, laser scanner data, terrestrial
DOIs: 10.5194/isprsannals-II-3-W4-189-2015

Bibliographical note
JUFOID=81104
Source: WOS
Source-ID: 000352727000025
Research output: Scientific - peer-review › Conference contribution

Motion Model for Positioning with Graph-Based Indoor Map

This article presents a training-free probabilistic pedestrian motion model that uses indoor map information represented as a set of links that are connected by nodes. This kind of structure can be modelled as a graph. In the proposed model, as a position estimate reaches a link end, the choice probabilities of the next link are proportional to the total link lengths (TLL), the total lengths of the subgraphs accessible by choosing the considered link alternative. The TLLs can be computed offline using only the graph, and they can be updated if training data are available. A particle filter in which all the particles
move on the links following the TLL-based motion model is formulated. The TLL-based motion model has advantageous theoretical properties compared to the conventional models. Furthermore, the real-data WLAN positioning tests show that the positioning accuracy of the algorithm is similar or in many cases better than that of the conventional algorithms. The TLL-based model is found to be advantageous especially if position measurements are used infrequently, with 10-second or more time intervals.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Authors: Nurminen, H., Koivisto, M., Ali-Löytty, S., Piche, R.
Number of pages: 10
Pages: 646-655
Publication date: 2015

Host publication information
Place of publication: Piscataway, NJ
Publisher: IEEE
ISBN (Electronic): 978-1-4673-8054-6
Electronic versions:
IPIN2014_final
DOIs:
10.1109/IPIN.2014.7275539
Links:
http://urn.fi/URN:NBN:fi:tty-201603013610

Bibliographical note
ORG=ase,0.8
ORG=mat,0.2
Source: researchoutputwizard
Source-ID: 24
Research output: Scientific - peer-review » Conference contribution

New Insights for Relational Capital
In this paper, we concentrate on relational capital, manifestation of the old adage “it is not what you know but who you know”. We propose that in this networked world, the importance of relationships between multiple stakeholders created by key personnel and financing becomes fundamental, and hence understanding and measuring those becomes fundamental, too. Accordingly, we highlight a need to go beyond social, individual or personal relationships and organizational context, as well as beyond the limitations of the dyadic (one actor to one actor) view on relationships. Hence, we are introducing the ecosystem as the context for measuring relational capital. This paper builds on a construct of ecosystemic relational capital, created for understanding and measuring the importance of relationships in the context of ecosystems. It looks at the totality of relationships both at organizational level and at individual level, measuring the structures and characteristics related to individuals, organizations as well as the ecosystem as a whole (Still et al. 2014a).

We acknowledge that the initial framework emphasizes the “networking capabilities” element of relational capital, with less attention to the element of "customer loyalty and reputation", which is the motivation for building on the construct. The processes of ecosystemic relational capital are built on the possibilities afforded by the volumes of digital data, mostly from social media, providing details on the relationships between various actors related to various regions, sectors, technologies and products. However, we propose enhancing the holistic integration for better understanding and measuring of relational capital with the application of methods of social network analysis (SNA), network visualizations and social media analytics. In this paper, we present concrete examples of the enhanced framework. At the same time, we acknowledge that there are many other avenues for obtaining novel insights for relational capital with these analytics, and we strongly encourage researchers and practitioners to do so.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Mathematics, Research group: MAT Intelligent Information Systems Laboratory
Authors: Still, K., Huhtamäki, J., Russell, M. G.
Number of pages: 16
Pages: 167-182
Publication date: 2015
Nondestructive estimates of above-ground biomass using terrestrial laser scanning

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Mathematics, Research group: MAT Inverse Problems, Mathematical modelling with wide societal impact (MathImpact)
Authors: Calders, K., Newnhamn, G., Burt, A., Murphy, S., Raumonen, P., Herold, M., Culvenor, D., Avitable, V., Disney, M., Armston, J., Kaasalainen, M.
Number of pages: 11
Pages: 198-208
Publication date: 2015
Peer-reviewed: Yes

Publication information
Journal: Methods in Ecology and Evolution
Volume: 6
Issue number: 2
ISSN (Print): 2041-210X
Ratings:
Scopus rating (2016): CiteScore 7.28 SJR 4.733 SNIP 2.621
Scopus rating (2015): SJR 5.382 SNIP 2.842 CiteScore 7.61
Scopus rating (2014): SJR 4.112 SNIP 2.452 CiteScore 6.29
Scopus rating (2013): SJR 3.011 SNIP 2.427 CiteScore 5.34
Scopus rating (2012): SJR 2.106 SNIP 1.648 CiteScore 3.56
Original language: English
DOIs:
10.1111/2041-210X.12301

Bibliographical note
Contribution: organisation=mat,FACT1=1<br/>Portfolio EDEND: 2014-12-16<br/>Publisher name: Wiley-Blackwell Publishing
Source: researchoutputwizard
Source-ID: 199
Research output: Scientific - peer-review › Article

Novel Method For Online Stereo Self-Calibration

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Authors: Melin, J., Ritala, R.
Publication date: 2015

Host publication information
Title of host publication: XXI IMEKO World Congress "Measurements In Research and Industry"
ISBN (Print): 978-80-01-05793-3
On constructibility and unconstructibility of LTS operators from other LTS operators

An LTS operator can be constructed from a set of LTS operators up to an equivalence if and only if there is an LTS expression that only contains operators from the set and whose result is equivalent to the result of the operator. In this publication this idea is made precise in the context where each LTS has an alphabet of its own and the operators may depend on the alphabets. Then the extent to which LTS operators are constructible is studied. Most, if not all, established LTS operators have the property that each trace of the result arises from the execution of no more than one trace of each of its argument LTSs, and similarly for infinite traces. All LTS operators that have this property and satisfy some other rather weak regularity properties can be constructed from parallel composition and hiding up to the equivalence that compares the alphabets, traces, and infinite traces of the LTSs. Furthermore, a collection of other miscellaneous constructibility and unconstructibility results is presented.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Mathematics, Regulation of learning and active learning methods (REALMEE)
Authors: Valmari, A.
Number of pages: 28
Pages: 207-234
Publication date: 2015
Peer-reviewed: Yes

Publication information
Journal: Acta Informatica
Volume: 52
Issue number: 2-3
ISSN (Print): 0001-5903
Ratings:
Scopus rating (2016): SJR 0.327 SNIP 0.928 CiteScore 0.97
Scopus rating (2015): SJR 0.437 SNIP 0.74 CiteScore 0.76
Scopus rating (2014): SJR 0.394 SNIP 0.91 CiteScore 0.73
Scopus rating (2013): SJR 0.528 SNIP 1.257 CiteScore 0.89
Scopus rating (2012): SJR 0.449 SNIP 0.97 CiteScore 0.8
Scopus rating (2011): SJR 0.497 SNIP 1.475 CiteScore 1.11
Scopus rating (2010): SJR 0.657 SNIP 1.316
Scopus rating (2009): SJR 0.578 SNIP 1.364
Scopus rating (2008): SJR 0.885 SNIP 1.351
Scopus rating (2007): SJR 0.794 SNIP 1.405
Scopus rating (2006): SJR 0.739 SNIP 1.316
Scopus rating (2005): SJR 0.803 SNIP 1.693
Scopus rating (2004): SJR 0.745 SNIP 1.366
Scopus rating (2003): SJR 0.817 SNIP 1.758
Scopus rating (2002): SJR 0.795 SNIP 1.347
Scopus rating (2001): SJR 0.754 SNIP 1.134
Scopus rating (2000): SJR 0.561 SNIP 1.18
Scopus rating (1999): SJR 0.379 SNIP 1.222
Original language: English
ASJC Scopus subject areas: Computer Networks and Communications, Information Systems, Software
Electronic versions:
AVActaInf2015
DOIs:
10.1007/s00236-015-0217-2
Links:
Source: Scopus
Source-ID: 84925463574
Research output: Scientific - peer-review › Article
On Robustness of Strongly Stable Semigroups with Spectrum on \( \text{iR} \)

We study the robustness properties of strong stability of a strongly continuous semigroup on a Hilbert space. We concentrate on a situation where the generator of the unperturbed semigroup has a finite spectral point on the imaginary axis and the resolvent operator is polynomially bounded elsewhere on the imaginary axis. As our main result we present conditions for preservation of the strong stability of the semigroup under bounded perturbations.

General information
State: Published
Ministry of Education publication type: A3 Part of a book or another research book
Organisations: Department of Mathematics, Research group: MAT Mathematical and semantic modelling
Authors: Paunonen, L.
Number of pages: 17
Pages: 105-121
Publication date: 2015

Host publication information
Title of host publication: Semigroups of Operators - Theory and Applications : Będlewo, Poland, October 2013
Publisher: Springer International Publishing
Editors: Banasiak, J., Bobrowski, A., Lachowicz, M.
ISBN (Print): 978-3-319-12144-4
ISBN (Electronic): 978-3-319-12145-1

Publication series
Name: Springer Proceedings in Mathematics & Statistics
Publisher: Springer International Publishing
Volume: 113
ISSN (Print): 2194-1009
Keywords: Strongly Continuous Semigroup, Functional Analysis
ASJC Scopus subject areas: Analysis
DOI:
10.1007/978-3-319-12145-1
Research output: Scientific - peer-review » Chapter

On Robust Output Regulation for Continuous-Time Periodic Systems

We construct a controller to solve robust output tracking problem for a stable linear continuous-time periodic system on a finite-dimensional space. We begin by transforming the time-dependent plant to a time-invariant discrete-time system using the "lifting technique". The controller is then designed to achieve robust output tracking for the lifted system. We show that an exact solution to the control problem for a continuous-time periodic system necessarily requires an error feedback controller with an infinite-dimensional internal model. The results are illustrated with an example where robust output tracking is considered for a stable periodic scalar system.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Mathematics, Research group: MAT Mathematical and semantic modelling
Authors: Paunonen, L.
Number of pages: 7
Publication date: 2015

Host publication information
Title of host publication: 2015 Proceedings of the SIAM Conference on Control and its Applications
Publisher: SIAM, Society for Industrial and Applied Mathematics
ASJC Scopus subject areas: Control and Optimization, Analysis
Electronic versions:
Article
DOI:
10.1137/1.9781611974072.7
Links:
http://urn.fi/URN:NBN:fi.tty-201603013598
Research output: Scientific - peer-review » Conference contribution

Ostinato: The Exploration-Automation Cycle of User-Centric, Process-Automated Data-Driven Visual Network Analytics
Practical Partial Order Reduction for CSP

FDR is an explicit-state refinement checker for the process algebra CSP and, as such, is vulnerable to the state-explosion problem. In this paper, we show how a form of partial-order reduction, an automatic state reduction mechanism, can be utilised to soundly reduce the number of states that must be visited. In particular, we develop a compositional method for partial-order reduction that takes advantage of FDR’s internal, compositional, process representation. Further, we develop novel methods of preserving the traces of a process which allow partial-order reduction to be applied to arbitrary FDR refinement checks. We also provide details on how to efficiently implement the algorithms required for partial-order reduction.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Mathematics, Research group: MAT Computer Science and Applied Logics, University of Oxford
Authors: Gibson-Robinson, T., Hansen, H., Roscoe, A. W., Wang, X.
Number of pages: 16
Pages: 188-203
Publication date: 2015

Host publication information
Title of host publication: Nasa Formal Methods : 7th International Symposium, NFM 2015, Pasadena, CA, USA, April 27-29, 2015, Proceedings
Volume: 9058
Publisher: Springer International Publishing
ISBN (Print): 978-3-319-17523-2
ISBN (Electronic): 978-3-319-17524-9

Publication series
Name: Lecture Notes in Computer Science
Volume: 9058
DOIs:
10.1007/978-3-319-17524-9_14

Projektioppiminen yläkoulun matematiikassa

General information
State: Published
Ministry of Education publication type: D1 Article in a trade journal
Organisations: Department of Mathematics
Authors: Viro, E., Eriksson, S.
Number of pages: 5
Pages: 1005-1009
Publication date: 2015
Peer-reviewed: Unknown

Publication information
Journal: Lumat
Volume: 3
Issue number: 7
ISSN (Print): 2323-7112
Original language: Finnish
Links:
http://luma.fi/lumat/4273

Research output: Professional › Article

Quantitative structure tree models from terrestrial laser scanner data

General information
State: Published
Ministry of Education publication type: D3 Professional conference proceedings
Reducing uncertainties in above-ground biomass estimates using terrestrial laser scanning

General information
State: Published
Ministry of Education publication type: D3 Professional conference proceedings
Organisations: Department of Mathematics, Research group: MAT Inverse Problems
Authors: Calders, K., Burt, A., Newnham, G., Disney, M., Murphy, S., Raumonen, P., Herold, M., Culvenor, D., Armston, J., Avitabile, V., Kaasalainen, M.
Number of pages: 3
Pages: 197-199
Publication date: 2015

Robustness of strong stability of discrete semigroups
In this paper we study the robustness of strong stability of a discrete semigroup on a Hilbert space under bounded perturbations. As the main result we present classes of perturbations preserving the strong stability of the semigroup.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Mathematics, Research group: MAT Mathematical and semantic modelling
Authors: Paunonen, L.
Number of pages: 6
Pages: 35-40
Publication date: 2015
Peer-reviewed: Yes

Publication information
Journal: Systems and Control Letters
Volume: 75
ISSN (Print): 0167-6911
Ratings:
Scopus rating (2016): CiteScore 3.64 SJR 2.711 SNIP 2.087
Scopus rating (2015): SJR 2.116 SNIP 1.765 CiteScore 3.11
Scopus rating (2014): SJR 2.105 SNIP 1.911 CiteScore 3.1
Scopus rating (2013): SJR 2.182 SNIP 2.037 CiteScore 3.46
Scopus rating (2012): SJR 2.042 SNIP 1.706 CiteScore 2.82
Scopus rating (2011): SJR 2.339 SNIP 2.016 CiteScore 2.58
Scopus rating (2010): SJR 1.904 SNIP 2.029
Scopus rating (2009): SJR 2.815 SNIP 2.444
Scopus rating (2008): SJR 3.224 SNIP 2.206
Scopus rating (2007): SJR 2.49 SNIP 1.754
Scopus rating (2006): SJR 1.919 SNIP 1.682
Robust Regulation of SISO Systems: The Fractional Ideal Approach

We solve the robust regulation problem for single-input single-output plants by using the fractional ideal approach and without assuming the existence of coprime factorizations. In particular, we are able to formulate the famous internal model principle for stabilizable plants which do not necessarily admit coprime factorizations. We are able to give a necessary and sufficient solvability condition for the robust regulation problem, which leads to a design method for a robustly regulating controller. The theory is illustrated by examples.

Robust Regulation Theory for Transfer Functions With a Coprime Factorization

Classical frequency domain results of robust regulation are extended by requiring only a right or a left coprime factorization of a plant, but not both. The famous internal model principle is generalized first, which leads to a necessary and sufficient solvability condition of the robust regulation problem and to a parametrization of all robustly regulating controllers. In addition, a procedure for constructing robustly regulating controllers is proposed.
Some Ring Theory from Jeno Szigeti
A selection of ring theory papers by Jeno Szigeti is reviewed with an emphasis on aspects related to matrix algebras.
Terrestrial LiDAR and 3D tree Quantitative Structure Model for quantification of aboveground biomass loss from selective logging in a tropical rainforest of Peru

General information
State: Published
Ministry of Education publication type: D3 Professional conference proceedings
Organisations: Department of Mathematics, Research group: MAT Inverse Problems, Wageningen Univ, Wageningen University & Research Center, Wageningen University and the UNESCO-IHE Institute for Water Education, Delft, The Netherlands, 18.10.2013, Center for International Forestry Research
Authors: Gonzalez de Tanago, J., Bartholomeus, H., Joseph, S., Herold, M., Avitabile, V., Goodman, R., Raumonen, P., Burt, A.
Number of pages: 3
Pages: 119-121
Publication date: 2015

Host publication information
Title of host publication: Proceedings of SilviLaser 2015: 14th conference on Lidar Applications for Assessing and Managing Forest Ecosystems
Links: https://silvilaser2015.teledetection.fr/files/Proceedings_Silvilaser_22_09_2015_2.pdf (Conference proceedings)
Research output: Professional › Conference contribution

Traceability of essential climate variables through forest stand reconstruction with terrestrial laser scanning

General information
State: Published
Ministry of Education publication type: D3 Professional conference proceedings
Organisations: Department of Mathematics, Research group: MAT Inverse Problems
Number of pages: 3
Pages: 122-124
Publication date: 2015

Host publication information
Title of host publication: Proceedings of SilviLaser 2015: 14th conference on Lidar Applications for Assessing and Managing Forest Ecosystems
Using context overlays to analyse the role of a priori information with Process Mining

Notwithstanding the significant advances in context-aware computing in pervasive computing and self-adaptive systems, there is still much more to be desired in providing better context services. The number of sensors deployed world-wide increases very rapidly. The Internet of Things, amongst others, generates vast amounts of data of many different data types. How data are used is essential to improve user experience and efficiencies of the systems in which they occur. We explain how familiar concepts of Process Mining strengthen generalised sensor context services. We present a laboratory case to explain the approach. By way of a real-world example, we confirm the viability of using Process Mining to strengthen context-aware computing.

Guard-based Partial Order Reduction

This paper aims at making partial-order reduction independent of the modeling language. To this end, we present a guard-based method which is a general-purpose implementation of the stubborn set method. We approach the implementation through so-called necessary enabling sets and do-not-accord sets, and give an algorithm suitable for an abstract model checking interface. We also introduce necessary disabling sets and heuristics to produce smaller stubborn sets and thus better reduction at low costs. We explore the effect of these methods using an implementation in the model checker LTSmin. We experiment with partial-order reduction on a number of Promela models, on benchmarks from the BEEM database in the DVE language, and with several with LTL properties. The efficiency of the heuristic algorithm is established by a comparison to the subset-minimal Deletion algorithm and the simple closure algorithm. We also compare our results to the Spin model checker. While the reductions take longer, they are consistently better than Spin’s ample set and often surpass the upper bound for the process-based ample sets, established empirically earlier on BEEM models.
Low-complexity Bayesian filtering for nonlinear models is challenging. Approximative methods based on Gaussian mixtures (GM) and particle filters are able to capture multimodality, but suffer from high computational demand. In this paper, we provide an in-depth analysis of a generalized GM (GGM), which allows component weights to be negative, and requires significantly fewer components than the traditional GM for ranging models. Based on simulations and tests with real data from a network of UWB nodes, we show how the algorithm’s accuracy depends on the uncertainty of the measurements. For nonlinear ranging the GGM filter outperforms the extended Kalman filter (EKF) in both positioning accuracy and consistency in environments with uncertain measurements, and requires only slightly higher computational effort when the number of measurement channels is small. In networks with highly reliable measurements, the GGM filter yields similar accuracy and better consistency than the EKF.
Finite Element Method for Electromagnetics on Riemannian Manifolds: Topology and Differential Geometry Toolkit

This thesis applies new branches of mathematics in computational electromagnetics software. Namely, we consider the application of algebraic topology and differential geometry in finite element modeling. We conclude that from this approach, one can draw benefits to practical electromagnetic modeling. For example, more efficient numerical formulations, field-circuit coupling, and metric and coordinate free modeling techniques. We present efficient methods for homology and cohomology computation of finite element meshes together with their software implementation. The presented homology and cohomology solver is a part of finite element mesh generator Gmsh. Therefore, its use can be easily incorporated into finite element modeling workflow. We demonstrate the use of homology and cohomology computation results in static and quasistatic electromagnetic field problems. We describe finite element formulations which can be used in lumped parameter extraction from field problems and which can be naturally coupled to electronic circuit problems. Importantly, cohomology computation enables the use of magnetic scalar potential in eddy current problems without any topological restrictions, leading to more efficient and robust field computations. Lastly, we present a finite element programming environment, where the language of differential geometry has the main role. We interpret the finite element model as a Riemannian manifold, and the fields of interest as differential forms. Using the environment, one can give the computational instructions in metric and coordinate free manner, as the used metric and coordinate system are provided separately. Then, the environment translates the instructions to the actual floating-point operations, which ultimately depend on the used metric and coordinate system. The programming environment implementation builds on top of the Gmsh API. That is, we implement tools from differential geometry which utilize an existing finite element framework. The main contribution of this thesis is the development of these tools to the point where they can be readily exploited in computationally demanding engineering problems. Also, this thesis offers a unified exposition of the needed mathematical concepts and their relation to the electromagnetic field problem formulations.

General information
State: Published
Ministry of Education publication type: G4 Doctoral dissertation (monograph)
Organisations: Department of Electrical Engineering
Authors: Pellikka, M.
Number of pages: 131
Publication date: 2 May 2014

Publication information
Place of publication: Tampere
Publisher: Tampere University of Technology
Original language: English
A Measurement-based Statistical Model to Evaluate Uncertainty in Long-range Noise Assessments

Carefully validated long-range sound propagation measurements with extensive meteorological instrumentation were continued for 612 days without interruption, around the clock, resulting in a database with millions of files, terabytes of sound and environmental data, and hundreds of pages of documentation. More than 100 environmental variables were analysed by statistical means, and many statistically highly significant dependencies linked to excess attenuation were found. At a distance of 3 km from the source, excess attenuation was spread over a dynamic range of 80 dB, with differences of 10 dB between individual quarters of the year; also, negative excess attenuation at frequencies below 400 Hz existed. The low frequencies were affected mainly by the stability characteristics of the atmosphere and the lapse rate. Humidity; lapse rate; sensible heat flux; and longitudinal, transverse, and vertical turbulence intensities explain excess attenuation at higher frequencies to a statistically highly significant extent. Through application of a wide range of regression analyses, a set of criteria for frequency-dependent uncertainty in sound propagation was created. These criteria were incorporated into a software module, which, together with a state-of-the-art physical sound propagation calculation module, makes it possible to perform environmental noise assessments with known uncertainty. This approach can be applied to the short term measurements too and it was shown that some of the most complex meteorological variables, among them atmospheric turbulence, can be taken into account. Comparison with two standardized noise modelling methods showed that the statistical model covers well a range of uncertainty not matched with the standardized methods and the measured excess attenuation fit within the limits of predicted uncertainty.

General information
State: Published
Ministry of Education publication type: G4 Doctoral dissertation (monograph)
Organisations: Department of Automation Science and Engineering
Authors: Maijala, P.
Number of pages: 178
Publication date: 3 Jan 2014

Publication information
Publisher: VTT
Original language: English

Publication series
Name: VTT Science
Publisher: VTT
Volume: 48
ISSN (Print): 2242-119X
ISSN (Electronic): 2242-1203
Electronic versions:
maijala
Links:

Bibliographical note
Awarding institution:Tampereen teknillinen yliopisto - Tampere University of Technology<br/>
Submitter:Submitted by Kaisa Kulkki (kaisa.kulkki@tut.fi) on 2013-12-18T08:26:49Z
No. of bitstreams: 1
maijala.pdf: 8876096 bytes, checksum: a9348271868d9cc37d85ecf3800e67ff (MD5)<br/>
Submitter:Approved for entry into archive by Kaisa Kulkki (kaisa.kulkki@tut.fi) on 2013-12-18T09:39:44Z (GMT)
No. of bitstreams: 1
maijala.pdf: 8876096 bytes, checksum: a9348271868d9cc37d85ecf3800e67ff (MD5)<br/>
Submitter:Made available in DSpace on 2013-12-18T09:39:44Z (GMT)
No. of bitstreams: 1
maijala.pdf: 8876096 bytes, checksum: a9348271868d9cc37d85ecf3800e67ff (MD5)
Source: researchoutputwizard
Source-ID: 123456789/21918
A field test of parametric WLAN-fingerprint-positioning methods

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Research group: MAT Positioning, Department of Automation Science and Engineering, Research group: Positioning, Wireless Communications and Positioning (WICO)
Authors: Muller, P., Raitoharju, M., Piche, R.
Number of pages: 8
Pages: 1-8
Publication date: 2014

Host publication information
Title of host publication: 17th International Conference on Information Fusion (FUSION), 7-10 July 2014, Salamanca, Spain
Place of publication: Piscataway
Publisher: Institute of Electrical and Electronics Engineers
ISBN (Print): 978-84-9012-355-3
Electronic versions:
Field test
Links:
http://urn.fi/URN:NBN:fi:tty-201603173640
http://ieeexplore.ieee.org/xpl/articleDetails.jsp?arnumber=6916170

Bibliographical note
The paper is available in ieeexplore, and will later also appear at http://isif.org/content/conference-proceedings<br/>

A method to enforce map constraints in a particle filter's position estimate

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Research group: MAT Positioning, Department of Automation Science and Engineering, Research group: Positioning, Wireless Communications and Positioning (WICO)
Authors: Piche, R., Koivisto, M.
Number of pages: 4
Publication date: 2014
An algebraic study of Peterson’s Intermediate Syllogisms

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Mathematics, Research Community on Data-to-Decision (D2D)
Authors: Turunen, E.
Number of pages: 14
Pages: 1-14
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Soft Computing
ISSN (Print): 1432-7643
Ratings:
Scopus rating (2016): SJR 0.75 SNIP 1.204 CiteScore 2.07
Scopus rating (2015): SJR 0.724 SNIP 1.179 CiteScore 1.53
Scopus rating (2014): SJR 0.793 SNIP 1.518 CiteScore 2.01
Scopus rating (2013): SJR 0.857 SNIP 1.454 CiteScore 2
Scopus rating (2012): SJR 0.805 SNIP 1.232 CiteScore 1.94
Scopus rating (2011): SJR 0.892 SNIP 1.817 CiteScore 2.38
Scopus rating (2010): SJR 0.736 SNIP 1.303
Scopus rating (2009): SJR 0.744 SNIP 1.417
Scopus rating (2008): SJR 0.776 SNIP 1.228
Scopus rating (2007): SJR 0.459 SNIP 0.742
Scopus rating (2006): SJR 0.466 SNIP 0.968
Scopus rating (2005): SJR 0.382 SNIP 0.876
Scopus rating (2004): SJR 0.227 SNIP 0.63
Scopus rating (2003): SJR 0.275 SNIP 0.297
Scopus rating (2002): SJR 0.235 SNIP 0.585
Scopus rating (2001): SJR 0.131 SNIP 0.783
Original language: English
DOIs:

Bibliographical note
Published online: 21 January 2014
Contribution: organisation=mat,FACT1=1
Portfolio EDEND: 2014-04-29
Publisher name: Springer
Source: researchoutputwizard
Source-ID: 1660
Research output: Scientific - peer-review › Article
A New Controller Structure for Robust Output Regulation

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Mathematics
Authors: Paunonen, L., Pohjolainen, S.
Number of pages: 6
Pages: 4721-4726
Publication date: 2014

Host publication information
Title of host publication: Proceedings of the 53rd IEEE Conference on Decision and Control, IEEE CDC 2014, 15-17 December, 2014, Los Angeles, CA, USA
Publisher: IEEE
ISBN (Print): 978-1-4673-6088-3

Another paraconsistent algebraic semantics for Lukasiewicz-Pavelka logic

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Mathematics, Research Community on Data-to-Decision (D2D)
Authors: Rodriguez, J. T., Turunen, E., Ruan, D., Montero, J.
Number of pages: 16
Pages: 132-147
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Fuzzy Sets and Systems
Volume: 242
ISSN (Print): 0165-0114
Ratings:
Scopus rating (2016): SJR 1.506 SNIP 1.977 CiteScore 2.88
Scopus rating (2015): SJR 1.43 SNIP 1.816 CiteScore 2.34
Scopus rating (2014): SJR 1.461 SNIP 2.278 CiteScore 2.67
Scopus rating (2013): SJR 1.439 SNIP 2.189 CiteScore 2.55
Scopus rating (2012): SJR 1.617 SNIP 2.468 CiteScore 2.97
Scopus rating (2011): SJR 1.518 SNIP 2.017 CiteScore 2.84
Scopus rating (2010): SJR 1.381 SNIP 2.189
Scopus rating (2009): SJR 1.337 SNIP 2.011
Scopus rating (2008): SJR 1.635 SNIP 2.139
Scopus rating (2007): SJR 1.554 SNIP 2.23
Scopus rating (2006): SJR 1.166 SNIP 2.306
Scopus rating (2005): SJR 0.846 SNIP 1.898
Scopus rating (2004): SJR 0.943 SNIP 1.773
Scopus rating (2003): SJR 0.789 SNIP 1.399
Scopus rating (2002): SJR 1.012 SNIP 1.127
Scopus rating (2001): SJR 0.944 SNIP 1.134
Scopus rating (2000): SJR 0.457 SNIP 1.275
Scopus rating (1999): SJR 0.458 SNIP 1.346
Appendix A: Application of Hill-Clohessy-Wiltshire Equation in GNSS Orbit Prediction

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Research group: MAT Positioning, Research group: Positioning, Wireless Communications and Positioning (WICO), Automation and Hydraulic Engineering, Department of Automation Science and Engineering
Authors: Zhang, X., Piche, R.
Number of pages: 6
Pages: 1-6
Publication date: 2014

Host publication information
Title of host publication: Proceedings of 2014 International Conference on Localization and GNSS (ICL-GNSS), Helsinki, Finland, June 24-26, 2014
Place of publication: Piscataway
Publisher: IEEE
Editors: Nurmi, J., Ruotsalainen, L., Lohan, E., Salcedo, J., Thombre, S.
Electronic versions:
Hill equation
DOIs: 10.1109/ICL-GNSS.2014.6934162
Links:
http://urn.fi/URN:NBN:fi:ttty-201603173647

Appendix B: A Simple Character String Proof of the "True but Unprovable" Version of Gödel's First Incompleteness Theorem

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Mathematics, Regulation of learning and active learning methods (REALMEE)
Authors: Valmari, A.
Number of pages: 15
Pages: 355-369
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Electronic Proceedings in Theoretical Computer Science
Volume: 151
Article number: 25
ISSN (Print): 2075-2180
Original language: English
DOIs: 10.4204/EPTCS.151.25
A Time-Harmonic Approach to Numerically Model Losses in the Metal Matrix in Twisted Superconductors in External Magnetic Field

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electrical Engineering
Authors: Lyly, M., Lahtinen, V., Stenvall, A., Rostila, L., Mikkonen, R.
Number of pages: 9
Pages: 1-9
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: IEEE Transactions on Applied Superconductivity
Volume: 24
Issue number: 2
ISSN (Print): 1051-8223

Ratings:
Scopus rating (2016): CiteScore 1.42 SJR 0.395 SNIP 1.031
Scopus rating (2015): SJR 0.35 SNIP 0.935 CiteScore 1.27
Scopus rating (2014): SJR 0.47 SNIP 1.113 CiteScore 0.83
Scopus rating (2013): SJR 0.431 SNIP 1.171 CiteScore 1.32
Scopus rating (2012): SJR 0.575 SNIP 1.27 CiteScore 1.11
Scopus rating (2011): SJR 0.364 SNIP 1.063 CiteScore 1.16
Scopus rating (2010): SJR 0.468 SNIP 1.073
Scopus rating (2009): SJR 0.452 SNIP 1.033
Scopus rating (2008): SJR 0.878 SNIP 0.987
Scopus rating (2007): SJR 0.611 SNIP 1.104
Scopus rating (2006): SJR 0.731 SNIP 0.935
Scopus rating (2005): SJR 0.645 SNIP 0.996
Scopus rating (2004): SJR 0.867 SNIP 0.9
Scopus rating (2003): SJR 0.494 SNIP 1.045
Scopus rating (2002): SJR 0.849 SNIP 1.024
Scopus rating (2001): SJR 0.523 SNIP 1.336
Scopus rating (2000): SJR 0.799 SNIP 0.95
Scopus rating (1999): SJR 1.073 SNIP 2.106
Original language: English
DOIs: 10.1109/TASC.2014.2308255

Bibliographical note
Contribution: organisation=dee,FACT1=1<br/>Portfolio EDEND: 2014-06-18<br/>Publisher name: Institute of Electrical and Electronics Engineers IEEE
Source: researchoutputwizard
Source-ID: 981
Research output: Scientific - peer-review › Article

Bagdad - matematiikkaa täältä ikuisuuteen matematiikanäyttely

General information
State: Published
Ministry of Education publication type: D1 Article in a trade journal
Bayesian Methods for Hybrid Indoor Positioning

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Automation Science and Engineering, Research group: Positioning
Authors: Nurminen, H.
Number of pages: 2
Publication date: 2014

Host publication information
Title of host publication: IPIN 2014 - 5th International Conference on Indoor Positioning and Indoor Navigation, 27th - 30th October, 2014, Busan, South Korea

Change Detection of Tree Biomass with Terrestrial Laser Scanning and Quantitative Structure Modelling

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Mathematics, Mathematical modelling with wide societal impact (MathImpact)
Authors: Kaasalainen, S., Krooks, A., Liski, J., Raumanen, P., Kaartinen, H., Kaasalainen, M., Puttonen, E., Anttila, K., Mäkipää, R.
Number of pages: 25
Pages: 3906-3922
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Remote Sensing
Volume: 6
Issue number: 5
ISSN (Print): 2072-4292
Ratings:
Scopus rating (2016): CiteScore 3.56 SJR 1.31 SNIP 1.661
Scopus rating (2015): SJR 1.339 SNIP 1.691 CiteScore 3.76
Scopus rating (2014): SJR 1.28 SNIP 1.886 CiteScore 3.23
Scopus rating (2013): SJR 1.167 SNIP 1.981 CiteScore 3.01
Evaluating the Consistency of Estimation

**General information**
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Research group: MAT Positioning, Department of Automation Science and Engineering, Department of Mathematics, Research group: Positioning, Wireless Communications and Positioning (WICO)
Authors: Ivanov, P., Ali-Löytty, S., Piche, R.
Number of pages: 5
Publication date: 2014

**Host publication information**
Title of host publication: Proceedings of 2014 International Conference on Localization and GNSS (ICL-GNSS), Helsinki, Finland, June 24-26, 2014
Place of publication: Piscataway
Publisher: IEEE
Electronic versions:
Ivanov consistency
DOIs:
10.1109/ICL-GNSS.2014.6934171
Links:
http://urn.fi/URN:NBN:fi:tty-201603173646

Gaussian Scale Mixture Models For Robust Linear Multivariate Regression With Missing Data
We present an algorithm for multivariate robust Bayesian linear regression with missing data. The iterative algorithm computes an approximative posterior for the model parameters based on the variational Bayes (VB) method. Compared to the EM algorithm, the VB method has the advantage that the variance for the model parameters is also computed directly by the algorithm. We consider three families of Gaussian scale mixture models for the measurements, which include as special cases the multivariate t distribution, the multivariate Laplace distribution, and the contaminated normal model. The observations can contain missing values, assuming that the missing data mechanism can be ignored. A Matlab/Octave implementation of the algorithm is presented and applied to solve three reference examples from the literature.

**General information**
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Research group: MAT Positioning, Department of Automation Science and Engineering, Department of Mathematics, Research group: Positioning
Authors: Ala-Luhtala, J., Piche, R.
Publication date: 2014
Peer-reviewed: Yes
Indirect Emissions of Forest Bioenergy: Detailed Modelling of Stump-Root Systems

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Mathematics, Mathematical modelling with wide societal impact (MathImpact)
Authors: Liski, J., Kaasalainen, S., Raumonen, P., Akujärvi, A., Krooks, A., Repo, A., Kaasalainen, M.
Number of pages: 8
Pages: 777-784
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Global Change Biology Bioenergy
Volume: 6
Issue number: 6
ISSN (Print): 1757-1693
Ratings:
Scopus rating (2016): SJR 1.734 SNIP 1.427 CiteScore 4.52
Scopus rating (2015): SJR 1.962 SNIP 1.61 CiteScore 5.14
Scopus rating (2014): SJR 2.385 SNIP 1.804 CiteScore 4.81
Integral Formulas for k-hypermonogenic Functions in R3

General information
State: Published
Ministry of Education publication type: A3 Part of a book or another research book
Organisations: Department of Mathematics
Authors: Eriksson, S., Orelma, H., Nelson, V.
Number of pages: 14
Publication date: 2014

Host publication information
Title of host publication: Hypercomplex Analysis: New Perspectives and Applications
Publisher: Springer
ISBN (Print): 978-3-319-08770-2
ISBN (Electronic): 978-3-319-08771-9

Publication series
Name: Trends in Mathematics
ISSN (Print): 2297-0215
DOI:
10.1007/978-3-319-08771-9_8

Bibliographical note
Contribution: organisation=mat,FACT1=1
Publisher name: Wiley-Blackwell
Source: researchoutputwizard
Source-ID: 957
Research output: Scientific - peer-review Article

Minimal Solutions of Fuzzy Relation Equations with General Operators on the Unit Interval

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Mathematics, Research Community on Data-to-Decision (D2D)
Authors: Medina, J., Turunen, E., Bartl, E., Diaz-Moreno, J. C.
Number of pages: 10
Pages: 81-90
Publication date: 2014

Host publication information
Publisher: Springer International Publishing
ISBN (Print): 978-3-319-08851-8
ISBN (Electronic): 978-3-319-08852-5

Publication series
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.
On polynomial stability of linear systems

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Mathematics
Authors: Paunonen, L., Laakkonen, P.
Number of pages: 6
Pages: 233-238
Publication date: 2014

Host publication information
Title of host publication: 21st International Symposium on Mathematical Theory of Networks and Systems, MTNS 2014, July 7-11, 2014, Groningen, the Netherlands
Place of publication: Groningen, the Netherlands
Publisher: University of Groningen

Publication series
Name: International Symposium on Mathematical Theory of Networks and Systems
Links:
https://fwn06.housing.rug.nl/mtns2014/

Bibliographical note
Contribution: organisation=mat,FACT1=1<br/>Portfolio EDEND: 2014-12-31<br/>Publisher name: University of Groningen
Source: researchoutputwizard
Source-ID: 1242
Research output: Scientific - peer-review › Conference contribution

On Vekua Systems and Their Connections to Hyperbolic Function Theory in the Plane

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Mathematics
Authors: Eriksson, S., Orelma, H.
Number of pages: 12
Pages: 1027-1038
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Advances in Applied Clifford Algebras
Volume: 24
Issue number: 4
ISSN (Print): 0188-7009
Ratings:
Scopus rating (2016): SJR 0.353 SNIP 1.199 CiteScore 0.74
Scopus rating (2015): SJR 0.313 SNIP 1.091 CiteScore 0.61
Optimal storage scheme for access point coverage data

General information
State: Published
Ministry of Education publication type: H1 Granted patent
Organisations: Department of Automation Science and Engineering, Research group: Positioning
Authors: Wirola, L., Laine, T., Raitoharju, M., Sirola, N.
Publication date: 2014

Publication information
Patent number: Pat. US 8 816 908 B2
Priority date: 26/08/14
Original language: English

Bibliographical note
Source: researchoutputwizard
Source-ID: 1799
Research output: Scientific › Patent

Performance of HQ02, an Optimized Version of the 120 mm Nb3Sn LARP Quadrupole

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electrical Engineering
Number of pages: 5
Pages: 1-5
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: IEEE Transactions on Applied Superconductivity
Volume: 24
Issue number: 3
ISSN (Print): 1051-8223
Ratings:
Polynomial stability of semigroups generated by operator matrices

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Mathematics
Authors: Paunonen, L.
Number of pages: 27
Pages: 885-911
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Journal of Evolution Equations
Volume: 14
Issue number: 4
ISSN (Print): 1424-3199
Ratings:
Scopus rating (2016): CiteScore 0.9 SJR 1.375 SNIP 1.033
Scopus rating (2015): SJR 0.896 SNIP 0.728 CiteScore 0.63
Scopus rating (2014): SJR 1.574 SNIP 1.234 CiteScore 0.81
Scopus rating (2013): SJR 1.319 SNIP 1.376 CiteScore 0.88
Scopus rating (2012): SJR 1.21 SNIP 1.388 CiteScore 0.88
Scopus rating (2011): SJR 1.578 SNIP 1.162 CiteScore 1
Scopus rating (2010): SJR 1.548 SNIP 1.074
Scopus rating (2009): SJR 1.602 SNIP 1.094
Scopus rating (2008): SJR 1.371 SNIP 1.18
Scopus rating (2007): SJR 0.834 SNIP 1.311
Scopus rating (2006): SJR 1.239 SNIP 1.255
Predicting tree structure from tree height using terrestrial laser scanning and quantitative structure models

**General information**
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Mathematics
Authors: Krooks, A., Kaasalainen, S., Kankare, V., Joensuu, M., Raumonen, P., Kaasalainen, M.
Number of pages: 11
Pages: 1-11
Publication date: 2014
Peer-reviewed: Yes

**Publication information**
Journal: Silva Fennica
Volume: 48
Issue number: 2
Article number: 1125
ISSN (Print): 0037-5330
Ratings:
Scopus rating (2016): SJR 0.65 SNIP 1.013 CiteScore 1.45
Scopus rating (2015): SJR 0.63 SNIP 0.998 CiteScore 1.46
Scopus rating (2014): SJR 0.605 SNIP 0.985 CiteScore 1.44
Scopus rating (2013): SJR 0.914 SNIP 1.175 CiteScore 1.79
Scopus rating (2012): SJR 0.881 SNIP 1.121 CiteScore 1.44
Scopus rating (2011): SJR 0.797 SNIP 1.076 CiteScore 1.46
Scopus rating (2010): SJR 0.728 SNIP 0.933
Scopus rating (2009): SJR 0.747 SNIP 1.184
Scopus rating (2008): SJR 0.718 SNIP 0.668
Scopus rating (2007): SJR 0.645 SNIP 0.915
Scopus rating (2006): SJR 0.666 SNIP 0.844
Scopus rating (2005): SJR 0.955 SNIP 1.005
Scopus rating (2004): SJR 0.986 SNIP 0.893
Scopus rating (2003): SJR 0.674 SNIP 0.886
Scopus rating (2002): SJR 0.48 SNIP 0.537
Scopus rating (2001): SJR 0.629 SNIP 0.785
Scopus rating (2000): SJR 0.958 SNIP 0.981
Scopus rating (1999): SJR 0.676 SNIP 0.774
Original language: English
DOIs: 10.1007/s00028-014-0243-5

**Bibliographical note**
Published online: 11 July 2014
Contribution: organisation=mat,FACT1=1
Portfolio EDEND: 2014-10-20
Publisher name: Birkhaeuser Verlag AG
Source: researchoutputwizard
Source-ID: 1239
Research output: Scientific - peer-review > Article
Quench Protection Study of the Nb3Sn Low-beta Quadrupole for the LHC Luminosity Upgrade

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electrical Engineering
Authors: Manfreda, G., Ambrosio, G., Marinozzi, V., Salmi, T., Sorbi, M., Volpini, G.
Number of pages: 5
Pages: 1-5
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: IEEE Transactions on Applied Superconductivity
Volume: 24
Issue number: 3
ISSN (Print): 1051-8223
Ratings:
Scopus rating (2016): CiteScore 1.42 SJR 0.395 SNIP 1.031
Scopus rating (2015): SJR 0.35 SNIP 0.935 CiteScore 1.27
Scopus rating (2014): SJR 0.47 SNIP 1.113 CiteScore 0.83
Scopus rating (2013): SJR 0.431 SNIP 1.171 CiteScore 1.32
Scopus rating (2012): SJR 0.575 SNIP 1.27 CiteScore 1.11
Scopus rating (2011): SJR 0.364 SNIP 1.063 CiteScore 1.16
Scopus rating (2010): SJR 0.468 SNIP 1.073
Scopus rating (2009): SJR 0.452 SNIP 1.033
Scopus rating (2008): SJR 0.878 SNIP 0.987
Scopus rating (2007): SJR 0.611 SNIP 1.104
Scopus rating (2006): SJR 0.731 SNIP 0.935
Scopus rating (2005): SJR 0.645 SNIP 0.996
Scopus rating (2004): SJR 0.867 SNIP 0.9
Scopus rating (2003): SJR 0.494 SNIP 1.045
Scopus rating (2002): SJR 0.849 SNIP 1.024
Scopus rating (2001): SJR 0.536 SNIP 1.336
Scopus rating (2000): SJR 0.799 SNIP 0.95
Scopus rating (1999): SJR 1.073 SNIP 2.106
Original language: English
DOIs:
10.1109/TASC.2013.2285099

Bibliographical note
Contribution: organisation=dee,FACT1=1<br/>Portfolio EDEND: 2014-12-31<br/>Publisher name: Institute of Electrical and Electronics Engineers IEEE
Source: researchoutputwizard
Source-ID: 1019
Research output: Scientific - peer-review » Article

Robustness of Controllers for SISO-Plants and Signals Generated by an Infinite-Dimensional Exosystem

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Mathematics
Authors: Laakkonen, P., Pohjolainen, S.
Number of pages: 6
Pages: 538-543
**Robustness of strong stability of semigroups**

**General information**
- State: Published
- Ministry of Education publication type: A1 Journal article-refereed
- Organisations: Department of Mathematics
- Authors: Paunonen, L.
- Number of pages: 34
- Pages: 4403-4436
- Publication date: 2014
- Peer-reviewed: Yes

**Publication information**
- Journal: Journal of Differential Equations
- Volume: 257
- Issue number: 12
- ISSN (Print): 0022-0396
- Ratings:
  - Scopus rating (2016): SJR 2.454 SNIP 1.844 CiteScore 1.98
  - Scopus rating (2015): SJR 2.752 SNIP 1.931 CiteScore 1.95
  - Scopus rating (2014): SJR 3.042 SNIP 1.891 CiteScore 1.78
  - Scopus rating (2013): SJR 2.715 SNIP 1.726 CiteScore 1.76
  - Scopus rating (2012): SJR 2.655 SNIP 1.778 CiteScore 1.64
  - Scopus rating (2011): SJR 2.188 SNIP 1.41 CiteScore 1.31
  - Scopus rating (2010): SJR 2.354 SNIP 1.58
  - Scopus rating (2009): SJR 2.417 SNIP 1.751
  - Scopus rating (2008): SJR 2.32 SNIP 1.606
  - Scopus rating (2007): SJR 2.018 SNIP 1.766
  - Scopus rating (2006): SJR 2.05 SNIP 1.74
  - Scopus rating (2005): SJR 1.892 SNIP 1.601
  - Scopus rating (2004): SJR 2.035 SNIP 1.547
  - Scopus rating (2003): SJR 1.928 SNIP 1.691
  - Scopus rating (2002): SJR 2.345 SNIP 1.775
  - Scopus rating (2001): SJR 1.884 SNIP 1.835
  - Scopus rating (2000): SJR 2.583 SNIP 1.758
  - Scopus rating (1999): SJR 2.523 SNIP 1.473
- Original language: English
- DOIs:
  - 10.1016/j.jde.2014.08.011
- Links:
The Internal Model Principle for Systems with Unbounded Control and Observation

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Mathematics
Authors: Paunonen, L., Pohjolainen, S.
Number of pages: 34
Pages: 3967-4000
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: SIAM Journal on Control and Optimization
Volume: 52
Issue number: 6
ISSN (Print): 0363-0129
Ratings:
Scopus rating (2016): CiteScore 2.3 SJR 1.933 SNIP 1.89
Scopus rating (2015): SJR 1.872 SNIP 1.554 CiteScore 1.92
Scopus rating (2014): SJR 1.765 SNIP 1.761 CiteScore 1.9
Scopus rating (2013): SJR 1.866 SNIP 2.018 CiteScore 1.95
Scopus rating (2012): SJR 2.1 SNIP 1.94 CiteScore 2.4
Scopus rating (2011): SJR 2.776 SNIP 2.2 CiteScore 2.33
Scopus rating (2010): SJR 1.836 SNIP 2.06
Scopus rating (2009): SJR 2.093 SNIP 1.942
Scopus rating (2008): SJR 2.228 SNIP 1.83
Scopus rating (2007): SJR 1.938 SNIP 1.654
Scopus rating (2006): SJR 1.95 SNIP 2.088
Scopus rating (2005): SJR 1.53 SNIP 1.829
Scopus rating (2004): SJR 2.053 SNIP 1.612
Scopus rating (2003): SJR 2.518 SNIP 2.219
Scopus rating (2002): SJR 2.971 SNIP 2.216
Scopus rating (2001): SJR 3.303 SNIP 2.043
Scopus rating (2000): SJR 3.247 SNIP 2.61
Scopus rating (1999): SJR 2.377 SNIP 1.889
Original language: English
DOIs:
10.1137/130921362

Bibliographical note
Contribution: organisation=mat,FACT1=1
Portfolio EDEND: 2014-10-20
Publisher name: Academic Press
Source-ID: 1240
Research output: Scientific - peer-review » Article

The Role of Exosystems in Output Regulation

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Mathematics
Tree Root System Characterization and Volume Estimation by Terrestrial Laser Scanning and Quantitative Structure Modeling

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Mathematics, Research group: MAT Inverse Problems, Mathematical modelling with wide societal impact (MathImpact)
Authors: Smith, A., Astrup, R., Raumonen, P., Liski, J., Krooks, A., Kaasalainen, S., Åkerblom, M., Kaasalainen, M.
Number of pages: 21
Pages: 3274-3294
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Forests: Open Access Journal
Volume: 5
ISSN (Print): 1999-4907
Ratings:
A linear state model for PDR+WLAN positioning

Indoor positioning based on WLAN signals is often enhanced using pedestrian dead reckoning (PDR) based on an inertial measurement unit. The state evolution model in PDR is usually nonlinear. We present a new linear state evolution model for PDR. In simulated-data and real-data tests of tightly coupled WLAN-PDR positioning, we find that the positioning accuracy with this linear model is almost as good as with traditional models when the initial state is known, and better when the initial state is not known. The proposed method is computationally light and is also suitable for smoothing.
A Lyapunov approach to strong stability of semigroups

In this paper we present Lyapunov based proofs for the well-known Arendt-Batty-Lyubich-Vu Theorem for strongly continuous and discrete semigroups. We also study the spectral properties of the limit isometric groups used in the proofs.
Bandwidth and Storage Reduction of Radio Maps for Offline WLAN Positioning

Most of the existing mobile device positioning methods require data connectivity, i.e. they work in the mobile-assisted, or online mode. However, this consumes energy, induces transmission costs and results in unnecessarily long time-to-first-fix. These issues can be alleviated using mobile-based, or offline, mode. In this mode the device carries a subset of the global radio map in memory for fast positioning without data connection. The challenge of this approach is the large size of the offline radio map that needs to be downloaded, stored and updated periodically in the mobile device. This paper presents a method to find the significant APs in the global radio map and proposes using only those in offline positioning in order to compress the size of the required offline radio map. We also propose a method to further compress the size of the offline radio map by hashing the globally unique AP BSSIDs into locally unique shortened BSSIDs. We test the proposed methods with real-world data.
Bayes trees and forests: combining precise empirical and theoretical tree models

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Mathematics
Authors: Kaasalainen, M., Potapov, I., Raumonen, P., Åkerblom, M., Sievänen, R., Kaasalainen, S.
Number of pages: 3
Pages: 61-63
Publication date: 2013

Host publication information
Title of host publication: 7th International Conference on Functional-Structural Plant Models, FSPM2013, FSPM2013, 9.-14.6.2013, Saariselkä, Finland
Place of publication: Vantaa
Publisher: Finnish Society of Forest Science; Finnish Forest Research Institute; University of Helsinki
Editors: Sievänen, R., Nikinmaa, E., Godin, C., Lintunen, A., Nygren, P.
ISBN (Print): 978-951-651-408-9

Publication series
Name: International Conference on Functional-Structural Plant Models
Links:

Bibliographical note
Contribution: organisation=mat,FACT1=1<br/>Portfolio EDEND: 2013-12-29<br/>Publisher name: Finnish Society of Forest Science; Finnish Forest Research Institute; University of Helsinki
Source: researchoutputwizard
Source-ID: 2449
Research output: Scientific - peer-review › Conference contribution

Canonical methods of constructing invariant tori by phase-space sampling

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Mathematics, Mathematical modelling with wide societal impact (MathImpact)
Authors: Laakso, T., Kaasalainen, M.
Number of pages: 6
Pages: 14-19
Publication date: 2013
Peer-reviewed: Yes

Publication information
Journal: Physica D: Nonlinear Phenomena
Volume: 243
Issue number: 1
ISSN (Print): 0167-2789
Ratings:
Scopus rating (2016): SJR 0.845 SNIP 1.266 CiteScore 1.71
Scopus rating (2015): SJR 1.035 SNIP 1.312 CiteScore 1.79
Scopus rating (2014): SJR 1.067 SNIP 1.204 CiteScore 1.71
Scopus rating (2013): SJR 1.029 SNIP 1.364 CiteScore 1.76
Scopus rating (2012): SJR 1.067 SNIP 1.234 CiteScore 1.69
Scopus rating (2011): SJR 0.959 SNIP 1.144 CiteScore 1.58
Scopus rating (2010): SJR 1.037 SNIP 1.11
Scopus rating (2009): SJR 1.009 SNIP 1.133
Scopus rating (2008): SJR 1.275 SNIP 1.224
Scopus rating (2007): SJR 1.339 SNIP 1.276
Challenges in Heterogeneous Web Data Analytics - Case Finnish Growth Companies in Social Media

Diverse data about various phenomena are implicitly available in the modern web. In particular websites categorized as social media provide rich and heterogeneous data about various entities such as people, corporations, brands as well as their properties and relationships. An analyst who seeks to leverage this diverse data is faced with the challenge of integrating and making sense of a set of heterogeneous data sources. In this paper, we provide an introduction and a problem statement for heterogeneous web data analytics. To further highlight and discuss practical challenges, we introduce a case study of Finnish growth companies in social media. Instead of a purely data-driven approach, the presented approach is rooted in the idea that an analyst can actively participate in the data collection and integration process, while the process can still retain repeatability and transparency. The key contribution of this paper is the statement of the challenges related to heterogeneous web data analytics.
Device self-calibration in location systems using signal strength histograms

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Automation Science and Engineering, Research group: Positioning, Wireless Communications and Positioning (WICO)
Authors: Laoudias, C., Piche, R., Panayiotou, C. G.
Number of pages: 17
Pages: 165-181
Publication date: 2013
Peer-reviewed: Yes

Publication information
Journal: Journal of Location Based Services
Volume: 7
Issue number: 3
ISSN (Print): 1748-9725
Ratings:
Scopus rating (2016): SJR 0.307 SNIP 0.78 CiteScore 1.2
Scopus rating (2015): SJR 0.253 SNIP 0.631 CiteScore 1.14
Scopus rating (2014): SJR 0.231 SNIP 1.382 CiteScore 1.4
Scopus rating (2013): SJR 0.395 SNIP 0.98 CiteScore 0.96
Scopus rating (2012): SJR 0.355 SNIP 0.968 CiteScore 0.96
Scopus rating (2011): SJR 0.283 SNIP 1.155 CiteScore 0.85
Scopus rating (2010): SJR 0.365 SNIP 1.488
Scopus rating (2009): SJR 0.151 SNIP 1.064

Original language: English
Electronic versions:
Laoudias self-calibration JLBS
DOIs:
10.1080/17489725.2013.816792
Links:
http://urn.fi/URN:NBN:fi:tty-201603173649

Bibliographical note
Contribution: organisation=ase,FACT1=1<br/>Portfolio EDEND: 2013-07-29<br/>Publisher name: Taylor & Francis
Source: researchoutputwizard
Source-ID: 2723
Research output: Scientific - peer-review › Article

Estimating Above Ground Biomass from Terrestrial Laser Scanning in Australian Eucalypt Open Forest

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Mathematics
Authors: Calders, K., Newnham, G., Herold, M., Murphy, S., Culvenor, D., Raumonen, P., Burt, A., Armston, J., Avitabile, V., Disney, M.
Number of pages: 7
Pages: 1-7
Publication date: 2013

Host publication information
Title of host publication: 13th International Conference on LiDAR Applications for Assessing Forest Ecosystems, SilviLaser 2013, 9.-11.10.2013. Beijing, China
Place of publication: Beijing, China
Publisher: Silvilaser Beijing 2013

Publication series
Name: International Conference on LiDAR Applications for Assessing Forest Ecosystems

Links:

Bibliographical note
Contribution: organisation=mat,FACT1=1<br/>Portfolio EDEND: 2013-12-29<br/>Publisher name: Silvilaser Beijing 2013
Source: researchoutputwizard
Source-ID: 2023
Research output: Scientific - peer-review › Conference contribution

Estimation of initial state and model parameters for autonomous GNSS orbit prediction

In self-assisted GNSS the orbit of a satellite is predicted by solving the differential equation that models its motion. Our motion model includes the most important forces: Earth's gravity, lunar and solar gravity and solar radiation pressure. Unmodeled forces are taken into account by using Gaussian white noise term with covariance matrix estimated offline from historical orbital data. The estimation of model parameters (solar radiation pressure and Earth orientation parameters) and initial state for the prediction includes both offline and online stages. In the offline stage, priors for the solar radiation pressure parameters are estimated using precise orbits issued by the International GNSS service (IGS). In the online stage, the satellite's broadcast ephemeris is used to estimate the initial state and model parameters. The estimation of the initial state is formulated as non-linear continuous-time filtering problem with discrete-time measurements. The filtering equations are solved numerically and the performance of different numerical methods (Extended, Cubature and Unscented Kalman filters) is compared. Using the estimated initial state and model parameters, the satellite orbits are predicted 5 days into the future. The accuracy and consistency of the predicted orbits is analysed by
comparing with the IGS precise ephemerides. In this paper only GPS satellites are considered, but the method can be extended to other satellite systems.

**General information**
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Research group: MAT Positioning, Department of Automation Science and Engineering, Department of Mathematics, Research group: Positioning
Authors: Ala-Luhtala, J., Seppänen, M., Ali-Löytty, S., Piche, R., Numminen, H.
Number of pages: 15
Pages: 1-15
Publication date: 2013

**Host publication information**
Place of publication: Tweed Heads, NSW, Australia
Publisher: IGNSS Society
Electronic versions: alaluhtala_estimation_of_initial_state_and_model.pdf
Links:
http://www.ignss.org
http://urn.fi/URN:NBN:fi:tty-201402041071

**Bibliographical note**
Contribution: organisation=mat,FACT1=0.5<br/>Contribution: organisation=ase,FACT2=0.5<br/>Portfolio EDEND: 2013-07-29<br/>Publisher name: IGNSS Society
Source: researchoutputwizard
Source-ID: 1897
Research output: Scientific - peer-review › Conference contribution

**Estimation of Model Parameters**

**General information**
State: Published
Ministry of Education publication type: A3 Part of a book or another research book
Organisations: Research group: MAT Positioning, Department of Automation Science and Engineering, Research group: Positioning
Authors: Piche, R.
Number of pages: 22
Pages: 169-190
Publication date: 2013

**Host publication information**
Title of host publication: Mathematical Modeling with Multidisciplinary Applications
Place of publication: Hoboken, NJ, USA
Publisher: John Wiley & Sons
Editor: Yang, X.
ISBN (Print): 978-1-118-9441-3
ISBN (Electronic): 978-1-118-45862-4
Links:

**Bibliographical note**
Contribution: organisation=ase,FACT1=1<br/>Portfolio EDEND: 2013-05-29
Source: researchoutputwizard
Source-ID: 3147
Research output: Scientific - peer-review › Chapter

**Estimation of the Mechanical Power of a Kite Wind Generator**

**General information**
State: Published
Fast Automatic Method for Constructing Topologically and Geometrically Precise Tree Models from TLS Data

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Mathematics
Authors: Raumonen, P., Casella, E., Disney, M., Åkerblom, M., Kaasalainen, M.
Number of pages: 3
Pages: 89-91
Publication date: 2013

Host publication information
Title of host publication: 7th International Conference on Functional-Structural Plant Models, FSPM2013, 9.-14.6.2013, Saariselkä, Finland
Place of publication: Vantaa
Publisher: Finnish Society of Forest Science; Finnish Forest Research Institute; University of Helsinki
Editors: Sievänen, R., Nikinmaa, E., Godin, C., Lintunen, A., Nygren, P.
ISBN (Print): 978-951-651-408-9

Publication series
Name: International Conference on Functional-Structural Plant Models
Links:

Bibliographical note
Contribution: organisation=mat,FACT1=1<br/>Portfolio EDEND: 2013-07-29<br/>Publisher name: Finnish Society of Forest Science; Finnish Forest Research Institute; University of Helsinki
Source: researchoutputwizard
Source-ID: 3243
Research output: Scientific - peer-review › Conference contribution

Fast automatic precision tree models from terrestrial laser scanner data

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Research group: MAT Inverse Problems, Mathematical modelling with wide societal impact (MathImpact)
Authors: Raumonen, P., Kaasalainen, M., Åkerblom, M., Kaasalainen, S., Kaartinen, H., Vastaranta, M., Holopainen, M., Disney, M., Lewis, P.
Number of pages: 30
Pages: 491-520
Publication date: 2013
Peer-reviewed: Yes
Iterative alternating sequential (IAS) method for radio tomography of asteroids in 3D

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Mathematics, Mathematical modelling with wide societal impact (MathImpact)
Authors: Pursiainen, S., Kaasalainen, M.
Number of pages: 15
Pages: 84-98
Publication date: 2013
Peer-reviewed: Yes

Publication information
Journal: Planetary and Space Science
Volume: 82-83
ISSN (Print): 0032-0633
Ratings:
Scopus rating (2016): SJR 1.248 SNIP 0.917 CiteScore 1.96
Scopus rating (2015): SJR 1.038 SNIP 1.052 CiteScore 1.96
Scopus rating (2014): SJR 1.119 SNIP 0.926 CiteScore 1.96
Scopus rating (2013): SJR 0.869 SNIP 0.819 CiteScore 1.59
Scopus rating (2012): SJR 1.29 SNIP 1.011 CiteScore 2.14
Scopus rating (2011): SJR 1.249 SNIP 0.911 CiteScore 1.96
Scopus rating (2010): SJR 1.353 SNIP 0.965
Scopus rating (2009): SJR 1.387 SNIP 1.128
Scopus rating (2008): SJR 1.484 SNIP 1.243
Scopus rating (2007): SJR 1.112 SNIP 1.056
Scopus rating (2006): SJR 1.045 SNIP 1.038
Scopus rating (2005): SJR 1.052 SNIP 1.051
Scopus rating (2004): SJR 1.054 SNIP 1.28
Scopus rating (2003): SJR 0.864 SNIP 0.963
Scopus rating (2002): SJR 0.838 SNIP 0.938
Scopus rating (2001): SJR 0.733 SNIP 0.67
Scopus rating (2000): SJR 0.676 SNIP 0.606
Scopus rating (1999): SJR 0.746 SNIP 0.563
Original language: English
DOIs: 10.1016/j.pss.2013.04.001

Bibliographical note
Contribution: organisation=mat,FACT1=1
Portfolio: EDEND: 2013-12-29
Publisher name: Pergamon
Source: researchoutputwizard
Source-ID: 3194
Research output: Scientific - peer-review › Article

Manifolds in electromagnetism and superconductor modelling: Using their properties to model critical current of twisted conductors in self-field with 2-D model
Normal Distributions Transform Occupancy Maps: Application to Large-Scale Online 3D Mapping

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Research group: MAT Positioning, Department of Mathematics, Research group: Positioning
Authors: Saarinen, J., Andreasson, H., Stoyanov, T., Ala-Luhtala, J., Lilienthal, A. J.
Number of pages: 6
Pages: 2233-2238
Publication date: 2013

Host publication information
Title of host publication: 2013 IEEE International conference on Robotics and Automation, ICRA, May 6-10, 2013, Karlsruhe, Germany
Place of publication: Piscataway, NJ
Publisher: IEEE
ISBN (Print): 978-1-4673-5641-1

Publication series
Name: IEEE International Conference on Robotics and Automation
ISSN (Print): 2152-4092
ISSN (Electronic): 1050-4729
DOIs: 10.1109/ICRA.2013.6630878
http://www.icra2013.org

Bibliographical note
Contribution: organisation=mat,FACT1=1
Portfolio EDEND: 2013-07-29
Publisher name: IEEE
Source-ID: 3322
Research output: Scientific - peer-review › Conference contribution

On the Structure of Robust Controllers for Infinite-Dimensional Systems

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Mathematics
Authors: Hämäläinen, T., Pohjolainen, S.
Number of pages: 4
Pages: 59-62
Publication date: 2013

Host publication information
Title of host publication: 12th European Control Conference, ECC 2013, Zürich, Switzerland, 17.-19.7.2013
Place of publication: Zürich, Sveitsi

Publication series
Name: IEEE International Conference on Robotics and Automation
ISSN (Print): 2152-4092
ISSN (Electronic): 1050-4729
DOIs: 10.1109/ICRA.2013.6630878
http://www.icra2013.org

Bibliographical note
Contribution: organisation=mat,FACT1=1
Portfolio EDEND: 2013-07-29
Publisher name: IEEE
Source-ID: 3322
Research output: Scientific - peer-review › Conference contribution
Output Regulation Theory for Distributed Parameter Systems with Unbounded Control and Observation

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Mathematics
Authors: Paunonen, L., Pohjolainen, S.
Number of pages: 6
Pages: 1083-1088
Publication date: 2013

Host publication information
Title of host publication: 52nd IEEE Conference on Decision and Control, IEEE CDC 2013, December 10-13, 2013, Florence, Italy
Place of publication: Piscataway, NJ
Publisher: IEEE
ISBN (Print): 978-1-4673-5716-6

Publication series
Name: IEEE Conference on Decision and Control
ISSN (Print): 0743-1546

Bibliographical note
Contribution: organisation=mat,FACT1=1<br/>Portfolio EDEND: 2013-12-29<br/>Publisher name: IEEE
Source: researchoutputwizard
Source-ID: 3110
Research output: Scientific - peer-review › Conference contribution

Particle filter and smoother for indoor localization
We present a real-time particle filter for 2D and 3D hybrid indoor positioning. It uses wireless local area network (WLAN) based position measurements, step and turn detection from a hand-held inertial sensor unit, floor plan restrictions, altitude change measurements from barometer and possibly other measurements such as occasional GNSS fixes. We also present a particle smoother, which uses future measurements to improve the position estimate for non-real-time applications. A lightweight fallback filter is run in the background for initialization, divergence monitoring and possibly re-initialization. In real-data tests the particle filter is more accurate and consistent than the methods that do not use floor plans. An example is shown on how smoothing helps to improve the filter estimate. Moreover, a floor change case is presented, in which the filter is capable of detecting the floor change and improving the 2D accuracy using the floor change information.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Research group: MAT Positioning, Department of Automation Science and Engineering, Department of Mathematics, Research group: Positioning, Wireless Communications and Positioning (WICO)
Authors: Nurminen, H., Ristimäki, A., All-Löytty, S., Piche, R.
Number of pages: 10
Pages: 137-146
Publication date: 2013

Host publication information
Pedestrian Navigation Based on Inertial Sensors, Indoor, Map, and WLAN Signals

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Computer Systems, Signal Processing Research Community (SPRC), Wireless Communications and Positioning (WICO)
Authors: Leppäkoski, H., Collin, J., Takala, J.
Pages: 287-296
Publication date: 2013
Peer-reviewed: Yes

Publication information
Journal: Journal of Signal Processing Systems
Volume: 71
Issue number: 3
ISSN (Print): 1939-8018
Ratings:
Scopus rating (2016): CiteScore 0.78 SJR 0.226 SNIP 0.625
Scopus rating (2015): SJR 0.228 SNIP 0.639 CiteScore 0.7
Scopus rating (2014): SJR 0.292 SNIP 1 CiteScore 0.99
Scopus rating (2013): SJR 0.27 SNIP 0.858 CiteScore 0.97
Scopus rating (2012): SJR 0.281 SNIP 0.869 CiteScore 1.04
Scopus rating (2011): SJR 0.252 SNIP 0.717 CiteScore 0.92
Scopus rating (2010): SJR 0.288 SNIP 0.829
Scopus rating (2009): SJR 0.293 SNIP 0.849
Scopus rating (2008): SJR 0.314 SNIP 0.661
Scopus rating (2007): SJR 0.34 SNIP 1.021
Scopus rating (2006): SJR 0.261 SNIP 0.688
Scopus rating (2005): SJR 0.379 SNIP 0.914
Scopus rating (2004): SJR 0.384 SNIP 1.05
Scopus rating (2003): SJR 0.561 SNIP 1.024
Scopus rating (2002): SJR 0.475 SNIP 1.004
Scopus rating (2001): SJR 0.316 SNIP 0.752
Scopus rating (2000): SJR 0.21 SNIP 0.592
Scopus rating (1999): SJR 0.189 SNIP 0.569
Original language: English
Electronic versions:
Leppakoski_JSPS(2013)_PedestrianNavigation
Process for Measuring and Visualizing an Open Innovation Platform: Case Demola

Open innovation breaks the traditional pattern for developing new innovation leading to new business and the activities toward it. Consequently, new requirements are posed to innovation measurement. Demola is an open innovation platform that takes real-life problems from companies and other organizations and puts together and facilitates projects where students from different universities come together to solve the problems. This paper describes a set of network visualizations and animations that were developed in co-creation with the Demola operators to make visible the activity that Demola has initiated. Moreover, the development process used to design the visualizations and the technical process that was applied are described and discussed. We claim that static network visualizations and animations of an open innovation platform development are useful in presenting, describing, marketing and selling the platform for existing and new stakeholders. Our experience shows that in order to develop visualizations and animations that meet the requirements set by the different stakeholders, an iterative and incremental development process is needed. Moreover, we claim that taking a data-driven approach to visualization development is a key enabler in supporting the development.
Reduced order internal models in robust output regulation

In this paper we consider robust output regulation and the internal model principle for infinite-dimensional linear systems. We concentrate on a problem where the control law is required to be robust with respect to a restricted class of perturbations. We show that depending on the class of admissible perturbations, it is often possible to construct a robust controller with a smaller internal model than the one given by the internal model principle. In addition, we also look for minimal classes of perturbations that make the full internal model necessary. We introduce a straightforward way of testing for robustness of the control law for a given set of perturbations. The test in particular shows that the robustness is only dependent on the way the perturbations affect the transfer function of the plant at the frequencies of the exosystem. The theoretic results are applied to designing controllers for a one-dimensional wave equation and for a system consisting of three independent shock absorber models.
Robustness of polynomial stability with respect to unbounded perturbations

In this paper we present conditions for the preservation of strong and polynomial stability of a strongly continuous semigroup under unbounded finite rank perturbations of its infinitesimal generator. In addition, we also improve recent perturbation results for bounded finite rank perturbations. The results are illustrated with two examples. In the first one we consider the preservation of stability of a one-dimensional wave equation that has been stabilized polynomially with boundary feedback. In the second example we find conditions for the preservation of polynomial stability of a multiplication semigroup under unbounded rank one perturbations.
Robustness properties of controllers with reduced order internal models

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Mathematics
Authors: Paunonen, L., Pohjolainen, S.
Number of pages: 6
Pages: 578-583
Publication date: 2013

Host publication information
Title of host publication: 12th European Control Conference, ECC 2013, Zürich, Switzerland, 17.-19.7.2013
Place of publication: Zürich, Switzerland
Publisher: European Control Association EUCA
ISBN (Print): 978-3-952-41734-8

Publication series
Name: European Control Conference
Volume: 12
Links:
Robust output regulation and the preservation of polynomial closed-loop stability

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Mathematics
Authors: Paunonen, L., Pohjolainen, S.
Number of pages: 28
Publication date: 2013
Peer-reviewed: Yes

Publication information
Journal: International Journal of Robust and Nonlinear Control
ISSN (Print): 1049-8923
Ratings:
Scopus rating (2016): CiteScore 3.57 SJR 2.206 SNIP 1.681
Scopus rating (2015): SJR 1.944 SNIP 1.648 CiteScore 3.12
Scopus rating (2014): SJR 2.258 SNIP 1.947 CiteScore 3.51
Scopus rating (2013): SJR 2.008 SNIP 1.942 CiteScore 3.41
Scopus rating (2012): SJR 1.853 SNIP 1.767 CiteScore 2.83
Scopus rating (2011): SJR 1.901 SNIP 1.792 CiteScore 2.41
Scopus rating (2010): SJR 1.617 SNIP 1.484
Scopus rating (2009): SJR 2.201 SNIP 2.074
Scopus rating (2008): SJR 1.732 SNIP 1.422
Scopus rating (2006): SJR 1.583 SNIP 1.381
Scopus rating (2005): SJR 0.732 SNIP 0.968
Scopus rating (2004): SJR 1.054 SNIP 1.245
Scopus rating (2003): SJR 1.361 SNIP 1.323
Scopus rating (2002): SJR 2.66 SNIP 1.372
Scopus rating (2001): SJR 2.473 SNIP 1.616
Scopus rating (2000): SJR 1.962 SNIP 1.479
Scopus rating (1999): SJR 0.893 SNIP 0.931
Original language: English
DOIs:
10.1002/rnc.3064

Bibliographical note
Online first; Article first published online: 24 AUG 2013
Contribution: organisation=mat,FACT1=1
Portfolio EDEND: 2013-11-29
Publisher name: John Wiley & Sons
Source: researchoutputwizard
Source-ID: 3112
Research output: Scientific - peer-review » Article

SO-I: a surrogate model algorithm for expensive nonlinear integer programming problems including global optimization applications

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Scopus rating (2002): SJR 2.038 SNIP 1.463
Scopus rating (2001): SJR 2.487 SNIP 1.199
Scopus rating (2000): SJR 2.316 SNIP 1.211
Scopus rating (1999): SJR 2.965 SNIP 1.259
Original language: English
DOIs: 10.1016/j.icarus.2013.01.010

Bibliographical note
Contribution: organisation=mat,FACT1=1<br/>Portfolio EDEND: 2013-12-29<br/>Publisher name: Academic Press
Source: researchoutputwizard
Source-ID: 2915
Research output: Scientific - peer-review › Article

Tiedonlouhintaa tieliikenneonnettomuussatasta

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Mathematics
Authors: Turunen, E.
Number of pages: 2
Pages: 7-8
Publication date: 2013
Peer-reviewed: Yes

Publication information
Journal: Liikenne
Volume: 31
Issue number: 2
ISSN (Print): 0359-9345
Original language: Finnish

Bibliographical note
Contribution: organisation=mat,FACT1=1<br/>Portfolio EDEND: 2014-09-30<br/>Publisher name: Liikennesuunnittelun Seura ry
Source: researchoutputwizard
Source-ID: 3586
Research output: Scientific - peer-review › Article

Twiiteryhmiä ja uutispäivittelyä - toimittajana sosiaalisessa mediassa

General information
State: Published
Ministry of Education publication type: D4 Published development or research report or study
Organisations: Department of Mathematics
Authors: Vainikka, E., Noppari, E., Heinonen, A., Huhtamäki, J.
Number of pages: 113
Publication date: 2013

Publication information
Publisher: Tampereen yliopisto. Viestinnän, median ja teatterin yksikkö. Journalismin, viestinnän ja median tutkimuskeskus, COMET
ISBN (Print): 978-951-44-9150-4
ISBN (Electronic): 978-951-44-9151-1
Original language: Finnish
Links:
http://www.uta.fi/cmt/tutkimus/comet/index.html

Bibliographical note
Contribution: organisation=mat,FACT1=1<br/>Portfolio EDEND: 2013-12-29
Source: researchoutputwizard
What's out there? Asteroid models for target selection and mission planning

General information
State: Published
Ministry of Education publication type: A3 Part of a book or another research book
Organisations: Department of Mathematics, Mathematical modelling with wide societal impact (MathImpact)
Authors: Kaasalainen, M., Durech, J.
Number of pages: 20
Pages: 131-150
Publication date: 2013

Host publication information
Title of host publication: Asteroids: prospective energy and material resources
Place of publication: Heidelberg
Publisher: Springer
Editor: Badescu, V.
ISBN (Print): 978-3-642-39243-6
ISBN (Electronic): 978-3-642-39244-3
DOIs: 10.1007/978-3-642-39244-3

Bibliographical note
Contribution: organisation=mat,FACT1=1<br/>Portfolio EDEND: 2013-12-29
Source: researchoutputwizard
Source-ID: 2448
Research output: Scientific - peer-review › Chapter
A simulator for infinite-dimensional systems with a self-tuning controller

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Mathematics
Authors: Åkerblom, M., Hämäläinen, T., Pohjolainen, S.
Pages: 5 p
Publication date: 2009

A Lukasiewicz-style Many-Valued Similarity Reasoning: Review

General information
State: Published
Ministry of Education publication type: A3 Part of a book or another research book
Organisations: Matematiikka
Authors: Turunen, E.
Number of pages: 34
Pages: 315-348
Publication date: 2003