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.

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Organisations: Mathematics, Research group: Computer Science and Applied Logics
Authors: Paunonen, L.
Number of pages: 5
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Name: Proceedings of the American Control Conference
Publisher: IEEE
Volume: 2017
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ASJC Scopus subject areas: Analysis, Control and Systems Engineering
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Research output: Scientific - peer-review » Conference contribution

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

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Volume: 27
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ISSN (Print): 0188-7009
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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
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.

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.
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.
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.

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
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Peer-reviewed: Yes

Publication information
Journal: Acta Universitatis Szegediensis: 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


General information
State: Published
Ministry of Education publication type: C2 Edited books
Organisations: Department of Mathematics, Research group: MAT Computer Science and Applied Logics, Regulation of learning and active learning methods (REALMEE), Embedded Electronics research unit of the Bio Electro and Mechanical Systems (BEAMS) department of the Université Libre de Bruxelles
Authors: Devillers, R. (ed.), Valmari, A. (ed.)
Publication date: 2015

Publication information
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Volume: 9115
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ISBN (Electronic): 978-3-319-19488-2
Original language: English
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.

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.
On Robustness of Strongly Stable Semigroups with Spectrum on 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.
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.
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.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Mathematics
Authors: Foldes, S.
Number of pages: 7
Pages: 115-121
Publication date: 2015
Peer-reviewed: Yes

Publication information
Journal: Miskolc Mathematical Notes
Volume: 16
Issue number: 1
ISSN (Print): 1787-2405
Ratings:
Scopus rating (2016): SJR 0.284 SNIP 0.484 CiteScore 0.38
Scopus rating (2015): SJR 0.33 SNIP 0.661 CiteScore 0.48
Scopus rating (2014): SJR 0.273 SNIP 0.586 CiteScore 0.44
Scopus rating (2013): SJR 0.241 SNIP 0.487 CiteScore 0.52
Scopus rating (2012): SJR 0.213 SNIP 0.388 CiteScore 0.67
Scopus rating (2011): SJR 0.105 SNIP 0.063 CiteScore 0.15
Original language: English
Keywords: LIE NILPOTENT RINGS, MATRIX-RINGS, POLYNOMIAL-IDENTITIES, DETERMINANTS, ALGEBRAS
Source: WOS
Source-ID: 000359454800011
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

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Publisher: IEEE
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Publication series
Name: IEEE Conference on Decision and Control

Bibliographical note
Contribution: organisation=mat,FACT1=1<br/>Portfolio EDEND: 2014-12-18<br/>Publisher name: IEEE
Source: researchoutputwizard
Source-ID: 1243
Research output: Scientific - peer-review › Conference contribution

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

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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-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
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
Scopus rating (2005): SJR 1.183 SNIP 1.179
Scopus rating (2004): SJR 1.464 SNIP 1.721
Scopus rating (2003): SJR 1.386 SNIP 2.785
Scopus rating (2002): SJR 0.808 SNIP 1.268
Original language: English
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10.1007/s00028-014-0243-5

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Robustness of strong stability of semigroups

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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
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10.1016/j.jde.2014.08.011
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The Internal Model Principle for Systems with Unbounded Control and Observation

General information
State: Published
The Role of Exosystems in Output Regulation

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Mathematics
Authors: Paunonen, L.
Number of pages: 5
Pages: 2301-2305
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: IEEE Transactions on Automatic Control
Volume: 59
Issue number: 8
ISSN (Print): 0018-9286
Ratings:
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.

General information
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Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Mathematics
Authors: Paunonen, L., Zwart, H.
Number of pages: 6
Pages: 673-678
Publication date: 2013
Peer-reviewed: Yes

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Volume: 62
Issue number: 8
ISSN (Print): 0167-6911
Ratings:
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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 2.061 CiteScore 2.58
Scopus rating (2010): SJR 1.904 SNIP 2.029
Scopus rating (2009): SJR 2.815 SNIP 2.444
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

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Place of publication: Zürich, Switzerland
Publisher: European Control Association EUCA
ISBN (Print): 978-3-952-41734-8

Publication series
Robust output regulation and the preservation of polynomial closed-loop stability

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

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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:
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Source: researchoutputwizard
Source-ID: 3112
Research output: Scientific - peer-review › Article