Fax:+30 31 997951
Phone: +30 31 997909
E-mail: svol@math.auth.gr
http://anadrasis.math.auth.gr/S.Vologiannidis.htm
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Vologiannidis Stavros

Education

Aristotle University of Thessaloniki (AUTH)

Department of Mathematics.

Degree of Mathematics

1997   AUTH

BSc Dissertation

Development of algorithms on Automatic Control using MAPLE V Release 3.

1998-today   AUTH

PhD student in the sector of Computer Science and Numerical Analysis of the Mathematics Department, under the supervision of professor A.I.G. Vardulakis with subject "**Algebraic Methods for the analysis and synthesis of linear multivariable Control systems**".

My research interests are in the general area of singular discrete time systems, and the development of robust numerical and symbolic algorithms for control systems synthesis and design.

My research interests include

- Analysis of discrete time AR/ARMA systems
- The study of equivalences between polynomial matrices which proved to be of crucial importance for the analysis and design of control systems.
- Development of symbolic algorithms for CACSD (Computer Aided Control System Design) using mainly Mathematica as the preferred framework for implementation and application of advanced numerical methods such as FFT and interpolation for the solution of control problems.
- The study of numerical methods for CACSD taking advantage of the special structure of certain polynomial matrix pencils.

1999   AUTH

Took some courses on **Fuzzy Control** in collaboration with professor Jan Jantzen of Technical University of Denmark.

Foreign Languages

- English (Proficiency)
- French (Sorbonne I)

Publications

Papers in International Journals (5 accepted, 2 under review)

1. N. P. Karampetakis and S. Vologiannidis, *DFT calculation of the generalized and Drazin inverse of a polynomial matrix*, *Applied Mathematics and Computation*, 2003, vol 143, pp 501-521.
   A new algorithm for the computation of the generalized and Drazin inverse, of polynomial matrices is presented. The proposed algorithms are based on the Fast Fourier transform and thus proved to be computationally attractive and accurate in contrast to other known algorithms. An implementation of the algorithms in the Mathematica programming language is included.

2. S. Vologiannidis and N. P. Karampetakis, *Inverses of Multivariable Polynomial Matrices by Discrete Fourier Transforms, Multidimensional Systems and Signal Processing, 15 (4): 341-361, October 2004.*
    The problem of the computation of the Moore-Penrose and Drazin inverse of a multivariable polynomial matrix is addressed. We use FFT and evaluation/interpolation techniques to provide a robust algorithm for the computation of the inverses of multivariable polynomial matrices. The numerical stability and performance with respect to speed of the algorithms is illustrated.

3. N. P. Karampetakis and S. Vologiannidis, *Infinite elementary divisor structure-preserving transformations for polynomial matrices, International Journal of Applied Mathematics and Computer Science, 2003, Vol. 13, No 4, pp 493-503.*
    The main purpose of this work is to propose two equivalence relations (via homogeneous polynomial matrices) between polynomial matrices that preserve both finite and infinite elementary divisor structures.

4. N. P. Karampetakis, S. Vologiannidis and A.I. Vardulakis, 2003, *Notions of equivalence for discrete time AR-representations*, *International Journal of Control, 15 April 2004, Vol. 77, No. 6, pp 584-597.*
    We develop a polynomial matrix transformation, which preserves both the finite and infinite elementary divisor structure and show its connection with other known transformations. We apply those results to the study of AR representations, where it is shown that their solutions (forward backward and symmetric) depend on both finite and infinite elementary divisors structures.

5. E.N. Antoniou, S. Vologiannidis, 2004, A new family of companion forms of polynomial matrices, Electronic Journal of Linear Algebra, 2004, Vol. 11, pp 78-87.
    A new family of companion forms associated to a regular polynomial matrix is presented. It is shown that the new family of companion forms preserves both the finite and infinite elementary divisors structure of the original polynomial matrix, thus all its members can be seen as linearizations of the corresponding polynomial matrix. Furthermore, for the special class of self-adjoint polynomial matrices a particular member is shown to be self-adjoint itself.

6. E.N. Antoniou, A.I.G. Vardulakis and S. Vologiannidis, 2003, *Numerical Computation of Minimal Polynomial Bases: A Generalized Resultant Approach, submitted for possible publication to Linear Algebra and its Applications.*
    We propose a new algorithm for the computation of a minimal polynomial basis of the left kernel of a given polynomial matrix F(s). The proposed method exploits the structure of the left null space of generalized Wolovich or Sylvester resultants to compute row polynomial vectors that form a minimal polynomial basis of left kernel of the given polynomial matrix. The entire procedure can be implemented using only orthogonal transformations of constant matrices and results to a minimal basis with orthonormal coefficients.

7. N. P. Karampetakis, S. Vologiannidis, 2004, *On the fundamental matrix of the inverse of a polynomial matrix and applications, submitted for possible publication.*
    The aim of this work is twofold: a) it uses the fundamental matrix of the resolvent of a regular pencil in order to provide an algorithm for the computation of the fundamental matrix of the inverse of a polynomial matrix, and b) it proposes a closed formula for the forward, backward and symmetric solution of an AutoRegressive Moving Average (ARMA). This closed formula is represented in terms of the fundamental matrix of the inverse of one of the polynomial matrices that describes the ARMA representation.

Papers in International Conferences with referees (8 accepted)

8. N. P. Karampetakis, S. Vologiannidis and A.I. Vardulakis, *Notions of equivalence for discrete time AR-representations*, 15th IFAC World Congress 2002, Barcelona.

9. N. P. Karampetakis and S. Vologiannidis, *Infinite elementary divisor structure-preserving transformations for polynomial matrices*, 8th IEEE International Conference on Methods and Models in Automation and Robotics, Szczecin, Poland, 2-5 September, 2002.

10. N. P. Karampetakis and S. Vologiannidis, *DFT calculation of the generalized and Drazin inverse of a polynomial matrix*, IEEE Conference on Computer Aided Control System Design CACSD'02, Glasgow, Scotland, 18-20 September 2002.

11. A.I. Vardulakis, N. P. Karampetakis, E. Antoniou, P. Tzekis and S. Vologiannidis, A descriptor systems package for Mathematica, 11th IEEE Mediterranean Conference on Control and Automation (MED'03), Rhodes, Greece.

12. S. Vologiannidis and N. P. Karampetakis, *Inverses of Multivariable Polynomial Matrices by Discrete Fourier Transforms*, European Control Conference 2003, Cambridge, 1-4 September 2003, U.K.

13. N. P. Karampetakis and S. Vologiannidis, *On the Laurent series expansion of the resolvent of a polynomial matrix and applications,* 12th IEEE Mediterranean Conference on Control and Automation (MED'04), Kusadasi, 6-9 June 2004, Turkey.

14. E.N. Antoniou and S. Vologiannidis, *On the Computation of Minimal Polynomial Bases,* 12th IEEE Mediterranean Conference on Control and Automation (MED'04), Kusadasi, 6-9 June 2004, Turkey.

15. Petr Kujan, Martin Hrom ík, Michael Šebek, N.P. Karampetakis, E.N. Antoniou, S. Vologiannidis, *Effective computations with 2-variable polynomial matrices in Mathematica*, 12th IEEE Mediterranean Conference on Control and Automation (MED'04), Kusadasi, 6-9 June 2004, Turkey.

Research Projects Aristotle University of Thessaloniki (AUTH)

1. **3/11/1999 - 2/11/2001.** Collaboration with UTIA in Prague (institute of Information Theory and Automation is a research institute of the Academy of Sciences of the Czech Republic), with subject "Development of algorithms and of a web-based mathematical package for analysis and synthesis of multivariable Control Systems". The project was funded by the Greek Secretariat of Research and Technology (GSRT).

2. **1/4/2000- 31/12/2000.** Participation as a software engineer and analyst in the project GALENOS (Generic advanced low-cost trans-European network over satellite). The project was included in the TEN-Telecom Programme of the European Community. This project allowed the establishment of a trans-European competence network via satellite dedicated to real-time telemedical applications. In total, 14 terminals have been installed and operated for over a year in six countries (France, Italy, Greece, Germany, Bulgaria and Tunisia), connecting up to 15 different hospitals. The operation of the network has been successfully

demonstrated in 9 occasions during exhibitions of worldwide renown (CEBIT, SATEXPO, MEDICA, etc.).

3. **6/11/2000 - 13/3/2002.** Worked as a researcher and programmer in the project entitled "Integrated software package for industrial and educational automatic control applications".

4. **11/2002 – now.** I work as a researcher and programmer for the development of an automatic control package for descriptor state space systems on Mathematica. The package will be deployed by Wolfram Research as an add-on to *Control System Professional*. (http://www.wolfram.com/products/applications/control/).

5. **1/7/2003 - now.** Collaboration with UTIA in Prague, Czech Republic with subject "Computer aided analysis and synthesis of discrete time filters in telecommunications via contemporary polynomial matrix methods". The project is funded by the Greek Secretariat of Research and Technology (GSRT).

Professional Experience	

December 1997 – January 1998   EKO
Modeling of chemical processes

We applied neural network techniques to model the reactors producing PVC in the Greek Petroleum Company EKO.

November 1997 – March 1998   INTERMALL SA
Network Administrator and programmer
- Web developer, Active Serve Pages (ASP), Microsoft SQL Server etc.
- Network Administration.

June 1999 – October 2001   UTN SA
Network Administrator and programmer.
- Network administration on a LAN with Windows NT 4.0 server, workstation, Windows 2000 and 98.
- Administration of a Xyplex Routerunner, and implementation of VLAN using a switch 3COM 2412M.
- Remote administration, log and statistics management through SNMP (simple network management protocol)
- Firewall
- Administration of a Unix Server (Redhat Linux) as Email server, Web server (Apache), DHCP server, IRC server.
- Development of E-commerce Web applications (business to business, business to consumer) on Microsoft platforms using Microsoft DNA (ASP, Microsoft SQL, XML, Visual Basic)
- Training from Forth-Ecom (http://www.forthe-com.gr) on the following software packages of Sterling Commerce   (http://www.sterlingcommerce.com) about EDI (Electronic Data InterChange)
  - GENTRAN: Server for Windows NT
  - GENTRAN: Integrator

1999 – Now

Software engineer and programmer

I established my own company providing software solutions (both intranet and internet applications). Some of the main applications developed during this time in cooperation with other companies are:

- ENI-Lib: electronic archiving of newspapers (installed in the Municipal Library of Thessaloniki and the Union of Journalists of Macedonia and Thrace)
- Development of an web and intranet software package for press clipping in collaboration with "Enimerosi SA" (http://www.apo.gr)
- Development of the web portal of the basketball club Aris Castrol (http://www.arisbc.gr).

Teaching Experience

1998-2002   AUTH

Mathematical theory of linear systems I, II

1998   INFOLAB SA

Training personnel intended to be employed as administrators on IBM AIX servers for the TAXIS project (computerization of Greek tax-offices).

1999   AUTH

General seminars on Windows and Microsoft Office in a project funded by the Greek Secretariat of Research and Technology (GSRT) with goal the education of teachers on new technologies.

1999   INFOLAB SA

Seminars on Adobe Photoshop 5.0

1999 - 2001   DELTA Ltd

Seminars on Windows, Microsoft Office.

2003   IEK

Seminars on data structures and databases.

2003   IEK

Seminars on networking.

Miscellaneous

During my degree, I worked on the computer labs of the mathematics and physics departments, co-administrating computers with the following Os:

- IBM 4381, VM/SP
- DEC, SUN, HP workstations (Aristoteles environment)

Programming experience in (Visual) C++, Java, Visual Basic, Perl, shell scripting etc.