

E-LETTER of the Numerics in Control Network NICONET
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CONTENTS:

- 1 Welcome to the NICONET E-letter number 12!
- 2 New issue of the NICONET newsletter available
- 3 New additions to SLICOT since April 2001
- 4 SLICOT developments
- 5 New NICONET Reports since May 2001
- 6 NICONET events
- 7 (Forthcoming) Meetings and symposia attended by NICONET partners

1 Welcome to the NICONET E-letter number 12!

This E-letter is sent out quarterly and informs you about the newest updates. Also, new NICONET reports and important NICONET activities are announced in this E-letter. In particular, I would like to mention that the proposal we sent to the EC in March 2001 (Accompanying Measures project in the Growth programme) has not been approved. We are exploring other ways of support for development of the SLICOT library after December 31, 2001, when the present NICONET project comes to its end.

The next issue of this E-letter is planned for October 2001. Please send contributions before September 30. In particular, we encourage contributors to provide information on the use of the SLICOT library (performance, improvements, new suggestions).

Sabine Van Huffel
Chairperson of WGS and Coordinator of NICONET.

2 New issue of the NICONET Newsletter available

Communicated by Sabine Van Huffel:

The 7th issue of our NICONET Newsletter is now available and can be downloaded as compressed postscript file from the World Wide Web URL:

<http://www.win.tue.nl/niconet/> and choose: Newsletters

or from the WGS ftp site:

<ftp://wgs.esat.kuleuven.ac.be> (directory pub/WGS/NEWSLETTER/)
(filename: issue-2-01.ps.Z)

Contents:

1. Editorial
2. Basic numerical SLICOT tools for control
3. SLICOT tools for model reduction
4. SLICOT tools for subspace identification
5. SLICOT tools for robust control
6. SLICOT tools for nonlinear systems in robotics
7. SLICOT: a useful tool in industry?
8. NICONET information corner
9. Announcement of upcoming SLICOT training course in Bremen, Germany

3 New additions to SLICOT since April 2001

Communicated by Vasile Sima:

The latest changes in the library contents or routine updates - till the next SLICOT Release - are announced in the file Release.Notes, located in directory /pub/WGS/SLICOT/ on the WGS ftp site. Previous updates are described, in reverse chronological order, in the file Release.History, located in the same directory.

SLICOT routines can be downloaded from the WGS ftp site:

<ftp://wgs.esat.kuleuven.ac.be>

(directory /pub/WGS/SLICOT/ and its subdirectories) in compressed (gzipped) tar files. On line .html documentation files are also provided there. The library and its documentation are also accessible from the WGS homepage at the World Wide Web URL:

<http://www.win.tue.nl/niconet/>

after linking from there to the SLICOT web page and clicking on the FTP site link in the freeware SLICOT section.

The latest major SLICOT Library update took place on June 29, 2001. Known bugs have been removed. This involved few changes in the routines AB08NX, AB09CX, MB04ZD, and SB16AY. Details are given in the file Release.Notes.

Several new user-callable and computational routines for basic control problems, for structured matrices, and for model and controller reduction have been posted on the SLICOT ftp site in June 29. They include Analysis Routines, Data Analysis Routines, Mathematical Routines, and Transformation Routines, performing the following main computational tasks:

- computing the normal rank of the transfer-function matrix of a state-space model (A,B,C,D).
- computing a reduced order model for an original state-space representation, using the frequency weighted optimal Hankel-norm approximation method; the weights are defined by $op(W)$, where $op(W)$ stands for W , $conj(W)$, $inv(W)$, or $conj(inv(W))$, with W a given transfer-function matrix, and they may be applied to the left, and/or to the right.
- constructing a state-space representation of the projection of $V*G$ or $conj(V)*G$ containing the poles of G , from the state-space representations of the transfer-function matrices G and V , for G assumed to be stable and with its state matrix A in a real Schur form.
- constructing a state-space representation of the projection of $G*W$ or $G*conj(W)$ containing the poles of G , from the state-space representations of the transfer-function matrices G and W , for G assumed to be stable and with its state matrix A in a real Schur form.
- checking stability/antistability of finite eigenvalues with respect to a given stability domain.
- computing the L-infinity norm of a continuous-time or discrete-time system (possibly unstable), either standard or in the descriptor form.
- computing the maximum singular value of a given continuous-time or discrete-time transfer-function matrix, either standard or in the descriptor form.
- computing the inverse of a given descriptor system.
- computing the convolution or deconvolution of two real signals using the Hartley transform.
- computing the (scrambled) discrete Hartley transform of a real signal.
- reducing the first blocks of a generator to proper form; (extended version of MB02CX, with a higher BLAS3 fraction and a pivoting scheme for rank-deficient generators).
- computing the incomplete Cholesky factor of a symmetric positive definite block Toeplitz matrix, defined by either its first block row, or its first block column.
- computing the Cholesky factor of a banded symmetric positive definite block Toeplitz matrix.
- computing the Cholesky factor of the matrix $T'*T$, with T a banded block Toeplitz matrix of full rank.
- solving overdetermined or underdetermined real linear systems involving a full rank block Toeplitz matrix.
- computing a full QR factorization of a block Toeplitz matrix of full rank.
- computing a low rank QR factorization with column pivoting of a block Toeplitz matrix.
- computing the product $C \leq \alpha*op(T)*B + \beta*C$, where α and β are scalars, T is a block Toeplitz matrix, and $op(T)$ is either T , or its transpose.

- reducing the matrices A and E of a system pencil corresponding to the descriptor triple (A-lambda E,B,C) to generalized upper Hessenberg form using orthogonal transformations.
- reducing the pair (A,E) of a descriptor system to a real generalized Schur form using an orthogonal equivalence transformation, and applying the transformation to the matrices B and C.

Moreover, six new mexfiles and over ten associated m-files, covering part of the issues above, have been made available.

Several new user-callable and computational routines for identification of Wiener systems have been implemented, are currently revised for improving the speed, and will be posted on the SLICOT ftp site in September.

In addition, parallel codes for model reduction and related computational problems (Lyapunov and Sylvester equations, SVD, etc.) have been developed, covering the following functionality:

- Balance and Truncate method.
- Singular Perturbation Approximation method.
- Hankel Norm Approximation method.
- coupled Lyapunov equations solver for the Cholesky factors (based on the Newton iteration for the matrix sign function).
- coupled Stein equations solver for the Cholesky factors (based on the Smith iteration).
- stable Sylvester equation solver (based on the Newton iteration for the matrix sign function).
- SVD of a matrix product.
- matrix sign function using classical Newton iteration.
- rank of upper triangular matrices.

These parallel routines are further revised and tested on a cluster of PCs.

4. SLICOT developments

Communicated by Sabine Van Huffel:

Five new SLICOT toolboxes for controller reduction, model reduction of high order systems, subspace identification, robust control and nonlinear systems are being prepared and will be available end 2001.

5 New NICONET Reports since May 2001

Communicated by Sabine Van Huffel:

The following NICONET reports can be downloaded as compressed postscript files from the World Wide Web URL:

<http://www.win.tue.nl/niconet> and choose: reports

or from the WGS ftp site:

<ftp://wgs.esat.kuleuven.ac.be> (directory pub/WGS/REPORTS/)

FILE NAME: SLWN2000-2.ps.Z

REPORT NUMBER: 20000-2
FORMAT: Compressed postscript.
AUTHORS: Daniel Kressner and Paul Van Dooren
TITLE: Factorizations and linear system solvers for matrices with Toeplitz structure
ABSTRACT: In this report we describe new routines for several factorizations of matrices with Toeplitz or block Toeplitz structure and show how this can be used to solve the corresponding systems of equations or least squares systems of equations. We also describe certain implementation details and show how to handle matrices of low rank or of low bandwidth. This report briefly introduces the H_{inf} loop shaping design.
STATUS: available since June 2000 but revised in June 2001

FILE NAME: SLWN2001-3.ps.Z
REPORT NUMBER: 20000-3
FORMAT: Compressed postscript.
AUTHORS: David Guerrero and Vicente Hernandez and Jose E. Roma
TITLE: Integration and development of routines for the parallel solution of Lyapunov equations by Hammarling's method
ABSTRACT: This report describes the integration of some routines for solving standard Lyapunov equations by Hammarling's method on parallel machines.
STATUS: available since June 2001

6 NICONET events

Communicated by Peter Benner:

First announcement of a workshop and training course

ADVANCED COMPUTATIONAL TOOLS FOR COMPUTER-AIDED CONTROL SYSTEMS DESIGN

September 27-29, 2001, University of Bremen, Germany

AIMS AND TOPIC:

With the ever-increasing complexity of control systems, efficient computational methods for their analysis and design are becoming more and more important. These computational methods need to be based on reliable and robust numerical software provided by well-tested and user-friendly software libraries.

This workshop and training course is intended as a tutorial on the use of the freeware Subroutine Library in Systems and Control Theory (SLICOT) for solving practical control engineering problems within computer-aided control systems design (CACSD) environments. SLICOT-based software usually has improved reliability and efficiency as well as extended functionality compared to the computational methods implemented in other CACSD software packages.

Some of the world's leading experts in the field of computational methods in CACSD will introduce SLICOT-based software to be used either within Matlab and the Matlab Control Toolbox or the CACSD package Scilab.

The course includes hands-on training during which participants will solve practical problems in control systems design using this software.

Fax: +49 (0) 421 218-4863
E-Mail: stoever@math.uni-bremen.de

You may register electronically at

<http://www.math.uni-bremen.de/zetem/workshops/cacsd/anmeldung.html>

Deadline for registration is September 1, 2001.

7 (Forthcoming) Meetings and symposia attended by NICONET partners

Communicated by Vasile Sima and Sabine Van Huffel:

Conferences related to the NICONET areas of interest, where NICONET partners presented or will present NICONET/SLICOT-related talks and papers, and/or disseminate information and promote SLICOT, are the following:

Fifth SIAM Conference on Control and its Applications, San Diego, USA, July 11-14, 2001.

SIAM Conference on Linear Algebra in Signals, Systems and Control, Boston, USA, August 13--16, 2001.

IFAC Workshop on Periodic Control Systems, Cernobbio-Como, Italy, August 27-28, 2001.

Third International Workshop on TLS and Errors-in-Variables Modeling, Arenberg Castle, Leuven, Belgium, August 27-29, 2001.

First SIAM-EMS Conference on Applied Mathematics in Our Changing World, Berlin, Germany, September 3-6, 2001.

European Control Conference (ECC 2001), Seminario de Vilar, Porto, Portugal, September 4-7, 2001.

GAMM Workshop on Numerical Linear Algebra with special emphasis on Numerical Methods for Structured and Random Matrices, Berlin, Germany, September 7-8, 2001.

END OF THE NICONET E-LETTER
