E-LETTER of the Numerics in Control Network NICONET
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1 Welcome to the NICONET E-letter number 1!

As announced in our first NICONET newsletter (accessible through World Wide Web at URL:

  http://www.win.tue.nl/wgs/niconet.html

or via anonymous ftp from:

  wgs.esat.kuleuven.ac.be/pub/WGS/NEWSLETTER/issue-1-98.ps.Z)

this E-letter provides more detailed information about the NICONET project. NICONET is the acronym for an EC thematic network, entitled ``Network for development and evaluation of numerically reliable software in control engineering and its implementation in production technologies''.
This E-letter informs you about the newest updates of the SLICOT library, the main product of NICONET, and its performance. Also, new NICONET reports, workshops, and other interesting NICONET realizations will be announced in this E-letter. We plan to send out the E-letter quarterly.
The next issue of this E-letter is planned for January 1999. Please send contributions before January 15. 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.

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2 New additions to SLICOT since July 1998

Communicated by Vasile Sima:

The latest SLICOT Library update took place in July 1998. The next library update will be on December 1998. The 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/wgs/

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

Several new user-callable routines for basic control problems will be made available in the near future on the ftp site. They include Analysis Routines
and Synthesis Routines, performing the following tasks:

- model reduction for unstable systems using the optimal Hankel-norm approximation method in conjunction with square-root balancing for the alpha-stable part of the system;
- model reduction for unstable systems using either the square-root or the balancing-free square-root Balance & Truncate (B & T) method in conjunction with left/right stable coprime factorization techniques;
- model reduction for unstable systems using either the square-root or the balancing-free square-root Singular Perturbation Approximation (SPA) model reduction method in conjunction with stable left/right coprime factorization techniques;
- compute the Hankel-norm of the alpha-stable projection of a transfer-function matrix for a state-space system;
- compute the H2 or L2 norm of the transfer-function matrix of a system without poles on the imaginary axis, for a continuous-time system, or on the unit circle, for a discrete-time system; if the H2-norm is computed, the system must be stable;
- apply a specified symplectic scaling to a Hamiltonian matrix;
- transform a Hamiltonian matrix to square-reduced form by a symplectic orthogonal similarity transformation;
- compute the eigenvalues of a Hamiltonian matrix in square-reduced form;
- compute the solution of a continuous-time algebraic Riccati equation using the matrix sign function method;
- compute estimates for reciprocal condition number and forward error bound on a solution of a continuous-time algebraic Riccati equation;
- compute estimates for reciprocal condition number and forward error bound on a solution of a continuous-time Lyapunov equation;
- compute estimates for reciprocal condition number and forward error bound on a solution of a discrete-time Lyapunov equation;
- compute the state-space representations of the factors of a left coprime factorization with prescribed stability degree;

- compute the state-space representations of the factors of a right
  coprime factorization with prescribed stability degree;
- compute the state-space representations of the factors of a left
  coprime factorization with co-inner denominator of a transfer-function
  matrix;
- compute the state-space representations of the factors of a right
  coprime factorization with inner denominator of a transfer-function
  matrix;
- compute the state-space representation of the transfer-function
  corresponding to a left coprime factorization;
- compute the state-space representation of the transfer-function
  corresponding to a right coprime factorization;
- solve for X either the generalized continuous-time Lyapunov equation

  op(A)'*X*op(E) + op(E)'*X*op(A) = sigma*Y,

  or the generalized discrete-time Lyapunov equation

  op(A)'*X*op(A) - op(E)'*X*op(E) = sigma*Y,

  where op(M) is either M or M' (M transpose), A and E are square
  matrices, the right hand side Y is symmetric, and sigma is a scale
  factor set to avoid overflow in X.
- solve for X = op(U)'*op(U) either the generalized c-stable
  continuous-time Lyapunov equation

  op(A)'*X*op(E) + op(E)'*X*op(A) = - sigma**2*op(B)'*op(B),

  or the generalized d-stable discrete-time Lyapunov equation

  op(A)'*X*op(A) - op(E)'*X*op(E) = - sigma**2*op(B)'*op(B),

  where A and E are square matrices, B is a rectangular matrix,
  U is an upper triangular matrix with non-negative entries on its
  main diagonal, and sigma is a scale factor set to avoid overflow
  in U.

Future 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, mentioned above. Previous
updates are described, in reverse chronological order, in the file
Release.History, at the same address.

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3 New NICONET Reports since July 1998

Contributed 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/wgs/reports.html

or from the WGS ftp site:

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

FILE NAME: SLWN1998-1.ps.Z
REPORT NUMBER: 1998-1
FORMAT: Compressed postscript.
AUTHORS: I. Blanquer, D. Guerrero, V. Hernandez, E. Quintana-Orti,
               and P. Ruiz

TITLE: Parallel-SLICOT Implementation and documentation standards
ABSTRACT: This paper presents the P-SLICOT (Parallel Subroutine Library in Control and Systems Theory) Implementation and Documentation Standards. Here we propose some useful guidelines for those who want to contribute to the parallel version of SLICOT. The main goal of these rules is to facilitate the work of obtaining a portable, reliable, and easily maintainable code.

FILE NAME: nic1998-7.ps.Z
REPORT NUMBER: 1998-7
FORMAT: Compressed postscript.
AUTHORS: Da-Wei Gu, Petko Hr. Petkov, and Mihail M. Konstantinov
TITLE: Direct Formulae for the H_{infinity} Sub-Optimal Central Controller
ABSTRACT: Alternative formulae, directly based on the original data of the given interconnected system, are presented for the H_{infinity} sub-optimal central controller.

FILE NAME: nic1998-8.ps.Z
REPORT NUMBER: 1998-8
FORMAT: Compressed postscript.
AUTHORS: Petko Hr. Petkov, Da-Wei Gu, and Mihail M. Konstantinov
TITLE: Fortran 77 routines for H_{infinity} and H_2 design of continuous-time linear control systems
ABSTRACT: Fortran 77 routines are presented for state-space design of H_{inifinity} (sub)optimal controllers and H_2 optimal controllers for linear continuous-time control systems. The subroutines make use of LAPACK and BLAS libraries and produce estimates of the conditioning of the corresponding matrix algebraic Riccati equations. Modified formulae are implemented in the case of H_{infinity} design which allows to reduce the order of the inverted matrices. The subroutines will be included in the SLICOT library.

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4 NICONET visits

Communicated by Dawei Gu:

During the summer, Professor Petko Hr. Petkov and Professor Mihail M. Konstantinov visited Leicester University, England. Together with the Leicester team, they developed H-infinity sub-optimal controller and H-2 optimal controller synthesis routines. The subroutine programs will shortly be included in the SLICOT library. Numerical aspects of those programs are discussed and summarised in two NICONET reports, 1998-7 and 1998-8, which are now available at the NICONET ftp site.

Communicated by Paul Van Dooren:

Paul Van Dooren visited Andras Varga at DLR from October 12 to October 23, 1998. During this visit they had technical discussions related to basic numerical methods for systems and control. They also worked on numerical methods for periodical systems and discussed future software additions related to model reduction of large scale systems with sparsity structure. Such techniques should exploit sparsity in order to still have a reasonable complexity.

Communicated by Sabine Van Huffel:

Sabine Van Huffel and Wouter Favoreel from the Department of Electrical Engineering, Katholieke Universiteit Leuven, visited Dominiek Coppens and Joris De Cuyper from LMS International, Leuven-Heverlee, Belgium, on July 16, 1998. During this visit they discussed the performance of several subspace identification algorithms for linear systems and the applicability of these methods to LMS technology.

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5 Meetings and symposia attended by NICONET partners

Communicated by Peter Benner:

The MTNS meeting in Padova, Italy, July 6-10, 1998, was attended by several NICONET partners: P. Benner, V. Mehrmann, V. Sima, P. Van Dooren, A. Varga, H.G. Xu, T. Penzl, H. Fassbender. Several talks related to the SLICOT library were presented and a short NICONET meeting was held in order to discuss the integration of SLICOT routines in Matlab.

Peter Benner presented NICONET as part of a presentation of the recently established "Zentrum fuer Technomathematik" (Center for Industrial Mathematics) at the University of Bremen to local industry.

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6 Coming NICONET events

Forthcoming Conferences related to the NICONET areas of interest, where NICONET partners submitted or will submit proposals for NICONET/SLICOT-related talks and papers, and/or will disseminate information and promote SLICOT, are the following:

- NICONET Workshop, Valencia, December, 1998 (organized by NICONET, with external participation).
- Computer-Aided Control System Design, CACSD '99, Hawaii, August 22-26, 1999.
- The Fourth International Congress on Industrial and Applied Mathematics, Edinburgh, Scotland, ICIAM99, July 5-9, 1999.
- European Control Conference, Karlsruhe, Germany, 31 August-3 September, 1999.

Communicated by Ignacio Blanquer Espert:

First NICONET WORKSHOP ON
NUMERICAL SOFTWARE
IN CONTROL ENGINEERING

Friday, December 4, 1998
Universidad Politecnica de Valencia.

Second Announcement and Call for Posters

This workshop organized by the European Numerics in Control thematic Network

(NICONET, http://www.win.tue.nl/wgs/niconet.html)

aims to bring together engineers, mathematicians, computer scientists and practitioners from industry and academia dealing with numerical software in systems and control and their implementation and use in industrial practice.

Recent advances will be discussed about the use of numerical software libraries specially designed for solving systems and control engineering problems in a numerically reliable and efficient way. The current status of the freely available SLICOT library will be extensively discussed, as well as its future, comprising parallel versions and it practically oriented benchmarks. Especially for large-scale, computer-intensive control problems and real-time applications, SLICOT could be a good tool for performance improvement.

Chairpersons: Vicente Hernandez (local organizer) and Sabine Van Huffel (project coordinator).

Organizing Committee: T. Backx, P. Benner, A. van den Boom, D. Coppens, A. Coville, F. Delebecque, D.W. Gu, S. Hammarling, B. Kagstrom, M. Konstantinov, V. Mehrmann, A. Moner, P. Petkov, V. Sima, A. Stoorvogel, P. Van Dooren, A. Varga, M. Verhaegen.

Workshop Objectives:

- To promote the advantages of using the numerical software library SLICOT in control engineering and industrial problems.
- To investigate the current interest of users in numerical software tools.
- To present the future of SLICOT (parallel computing, real benchmarks, new application areas,...
- To get feedback on good candidate areas (those with high cost, large problem sizes, real-time constraints,...) for applying SLICOT.
- To demonstrate the feasibility of using SLICOT in industrial applications.

Workshop Program:

- Plenary session:
  + "Numerical Problems in Nonlinear Control Systems" by Prof. Pedro Albertos (Universidad Politecnica de Valencia).
  + "Numerical Problems in Industrial Control Systems" by Prof. Ton Backx (Aspen Tech and Eindhoven University of Technology).
  + "Performance and Applicability of the SLICOT Library" by Prof. Ad van den Boom (Eindhoven University of Technology) and Dr. Vasile Sima (Research Institute for Informatics, Bucharest).
- Demo and poster sessions on new developments and performance presentations of control software in engineering practice and industrial applications and comparisons between SLICOT and other tools.
- A panel discussion on the importance and needs of numerics in control software in industry.

The preliminary, as well as the final program, will be announced on the NICONET website (http://www.win.tue.nl/wgs/niconet.html).

Participants of the workshop receive:

- A free copy of the last version of the SLICOT Software Library.
- Documentation on SLICOT and NICONET.
- Subscription to electronic bulletins and information lists.

Authors are invited to submit two copies of a one page abstract to the workshop secretariat for review. Address and e-mail should be provided if possible. Authors of accepted contributions will be asked to prepare a poster of their presentation.

Author's Schedule:
Submission of one page abstract (EXTENDED): October 30, 1998
Notification of acceptance as poster presentation November 7, 1998

Please submit your abstracts by ordinary or electronic mail or fax at the address shown below.

Registration Information:
Please register your attendance to the workshop at the address below before November 15, 1998. The attendance to the workshop, the documentation and the software is free.

Registration Form:

Name:
Title:
Company/Institution:
Area:
Address:
Phone:
Fax:
e-mail:

To the attention of Prof. Vicente Hernandez at the workshop secretariat

By Fax: 34-96-3877359

By Mail: Departamento de Sistemas Informaticos y Computacion
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By WWW: http://www-copa.dsic.upv.es/niconet/wshopSLICOT/register.html

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END OF THE NICONET E-LETTER
