Report of the IEEE CSS on CACSD

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Here is a summary of the activities of the TC

during the second semester of 2008.

\*\*\* Software developments \*\*\*

C. SciYalmip v1.0 beta - http://www.laas.fr/OLOCEP/SciYalmip/index.html

SciYalmip is an attempt to implement within the Scilab environment

the existing Matlab package YALMIP developed by Johan Loefberg

for defining and solving advanced optimization problems. SciYalmip cannot

support the whole family of solvers that are supported by YALMIP due

to Matlab dependencies. However, the current version of SciYalmip supports

2 Scilab external solvers: CSDP by Brian Borchers and SDPA by Masakazu

Kojima's team. Also there are some Scilab internal solvers which are being

supported: LMISOLVER, LINPROG, QUADPROG. SciYalmip was designed to keep

the interface as close as possible to Matlab's YALMIP. So if you are

familiar with YALMIP, it should not be too difficult to start using SciYalmip.

SciYalmip has been tested on Linux and Windows based platforms.

It has been developed by Sergey Solovyev (N.I.Lobachevskii Univ. Nizhny

Novgorod, Russia) and Pavel Pakshin (R.E.Alekseev Nizhny Novgorod State

Tech. Univ, Russia).

\*\*\* Numerical methods for polynomials \*\*\*

I would like to mention several recent developments in numerical

methods for polynomials, with the hope that they may have some

impact onto computer-aided control system design methods.

On page 32 of the excellent survey article [N. J. Higham, M. Konstantinov,

V. Mehrmann, P. Petkov. The sensitivity of computational control

problem. IEEE Control Systems Magazine, February 2004], the authors

claim that "Numerical analysts usually prefer the matrix/vector

setting over polynomial and rational functions", or in other words,

state-space methods over polynomial methods. They explain that

"The reason for the preference for the matrix/vector approach

in numerical methods is that the sensitivity of the polynomial

or rational representation is usually higher than that of a

matrix/vector representation". Recent achievements in numerical,

methods for polynomials may however change the trend, in

my opinion:

. chebfun project by N. F. Trefethen's team at Oxford Univ, UK -

Collection of algorithms and software system in object-oriented Matlab,

which extends familiar powerful methods of numerical computation involving

numbers to continuous or piecewise-continuous functions. The idea

is to use Chebyshev polynomial bases in a numerically stable and

efficient way. Polynomial interpolation and root extraction can be

carried out easily on polynomials of degree a thousand or more. See

http://www.comlab.ox.ac.uk/projects/chebfun

. apatools project by Z. Zeng at Northeastern Illinois Univ, USA -

A software toolbox for Approximate Polynomial Algebra, implemented

for Maple and Matlab. The software can compute to machine precision

polynomial roots of high multiplicity, e.g. for the polynomial

(x-1)^30(x-2)^18(x-3)^12, see http://www.neiu.edu/~zzeng/apatools.htm

. eigensolve algorithm by S. Fortune, Bell Labs, USA - Iterative

algorithm that approximates roots of a polynomial by computing

eigenvalues of companion matrices expressed in Lagrange bases.

The algorithm can e.g. compute roots of the Wilkinson polynomial

(x-1)(x-2)..(x-200), see [S. Fortune. An iterated

eigenvalue algorithm for approximating roots of univariate

polynomials. J. Symbolic Computation, 33:627-646, 2002] and

http://www1.bell-labs.com/topic/swdist

. mpsolve algorithm by D. Bini, G. Fiorentino, Univ. Pisa, Italy -

Can also approximate roots of univariate polynomials of high degree, see

[D. A. Bini, G. Fiorentino. Design, Analysis, and Implementation of

a Multiprecision Polynomial Rootfinder. Numerical Algorithms,

23:127-173, 2000] and http://www.dm.unipi.it/cluster-pages/mpsolve/

. spectral factorization of discrete-time polynomials of degree

up to one million could be achieved with a Matlab implementation

using the FFT, see [G. A. Sitton, C. S. Burrus, J. W. Fox, S. Treitel.

Factoring very-high-degree polynomials. IEEE Signal Processing Magazine,

November 2003]

It is hoped that these recent achievements can help control engineers

design efficient and numerical reliable polynomial methods.

\*\*\* Conferences \*\*\*

N. Karampetakis (AG on symbolic methods) organizes the 6th

International Workshop on Multidimensional (nD) Systems in

Thessaloniki, Greece, June 29-July 1, 2009, http://www.nds09.org

Deadline for submission of full papers and special sessions is

February 1st, 2009.

N. Karampetakis was an invited session chair of the International

Symposium on Computer-Aided Control Systems Design, IEEE

Multiconference on Systems & Control (MSC'08), San Antonio,

Texas, September 3-5, 2008.

V. Sima (AG on numerics) organized and chaired an invited session

at this conference. The session was co-organized and co-chaired

by Daniel Kressner.

D. Peaucelle and Y. Ebihara (AG on LMIs) organized an

invited session at the IFAC World Congress 2008 in cooperation with

Yasuaki Oishi, Nanzan University, Japan.

The session title is "LMIs and Algebraic Methods in Control".

P. Mostermann (AG on hybrid dynamical systems) is the industrial

co-chair of the 2009 IFAC Conference on Analysis and Design

of Hybrid Systems.

M. Hromcik (AG on polynomial methods) organized an invited session

at the IFAC World Congress 2008. Together with V. Kucera, he is

preparing a workshop on polynomial design methods at the EUROCAST 2009

event, to be held in February 2009 in Las Palmas de Gran Canaria,

Spain.

\*\*\* Journals, books \*\*\*

P. Mostermann (AG on hybrid dynamical systems) is about to kick off

a series of books on Computational Analysis, Synthesis, and Design of

Dynamic Systems for CRC Press, see

http://msdl.cs.mcgill.ca/people/mosterman/calls/casd/casd\_cfa.pdf

Anybody who has any interest in publishing as part of this series is

encouraged to contact P. Mostermann.

\*\*\* Next meeting \*\*\*

I am planning a meeting of the TC during the European Control

Conference, 23-26 August 2009, Budapest, Hungary.