The Department of Electronics, Carleton University and IEEE Ottawa, EDS/SSCS/CASS, and CPMT are inviting all interested IEEE members, entrepreneurs, academics, scientists, industry leaders, engineers, technologists, and students to the Seminar on:

Model Order Reduction for Coupled Systems

By

Prof. Wil Schilders

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The Netherlands

DATE: Tue, May 26, 2015.
TIME: 11am– 1pm
PLACE: ME4124, Mackenzie Eng. Building, Carleton University, 1125 Colonel By Drive, Ottawa, Ontario, Canada

Refreshments: will be served.
ADMISSION: Free.

Abstract

Coupled systems occur in many engineering applications, in particular in multi-physics problems. The coupling consists of the interaction, weak or strong, between different subsystems, described by different physical quantities such as temperature, structural mechanical displacements and electro-magnetic fields. After numerical discretization of the mathematical models of the coupled systems, the discretized systems are usually complex and of very large scale. This motivates the application of model order reduction techniques, intending to reduce the number of degrees of freedom, enable practical computation, and furthermore, significantly reduce the computational time.

Model order reduction for coupled systems has been studied in structural dynamics since the 1960s, where a component mode synthesis (CMS) method was proposed [1]. An overview of CMS methods can be found in [2]. In [3], the problem how to choose the important modes of the subsystems within CMS methods is addressed, and a moment-matching approach for choosing important modes is proposed. The CMS method builds upon the modal truncation method known in control and mechanical engineering, and in this sense, CMS belongs to modal truncation methods.

Besides the CMS method widely used in structural dynamics, MOR methods based on systems and control theory like balanced truncation, and MOR methods based on approximation theory like moment-matching, as well as the MOR methods popular in mechanical engineering and fluid dynamics like the reduced basis method, proper orthogonal decomposition (POD), have been subsequently applied to coupled systems, and have achieved significant efficiency for various multi-physics problems. In this presentation, we discuss a new approach to the solution of coupled problems, based upon low rank approximations of the coupling blocks. The work is described in [4,5]. A recent overview of MOR methods for coupled systems is given in [6]..

Speakers' Bio

Wil Schilders obtained his degree in mathematics from Radboud University Nijmegen (NL) in 1978, and a PhD in numerical mathematics from Trinity College Dublin in 1980. He then joined Philips Research in Eindhoven, where he worked on numerical algorithms for the simulation of

semiconductor devices, electronic circuits, and electromagnetic problems. In 2006, he moved to NXP Semiconductors. Since 1999, he is a part-time professor at TU Eindhoven. In 2010, he became director of the national platform for mathematics in The Netherlands, and currently combines this with his position at TU Eindhoven where he also leads the Project Development Office, responsible for acquiring national and European funding. He is in the boards of ECMI (European Consortium for Mathematics in Industry) and EU-MATHS-IN, and is the initiator and chair of the European Model Reduction Network (EU-MORNET). Current research interests are indefinite linear systems, smoothed particle hydrodynamics simulations, and model order reduction. He edited a monograph on MOR ("Model Order Reduction: theory, research aspects and applications"), and recently worked on MOR methods for coupled problems and differential-algebraic systems.