CAMM project presentation day

Thursday December 10th, 10.15-14.30

DTU Electrical Engineering, Ørsteds Plads, Building 352, room 019

Program:

10.15-10.30: Coffee & cake

10.30-10.35: Introduction

10.35–12.00: Vibro- and micro-acoustics:

- **Ester Creixell Mediante** - *Modelling mechanical contact uncertainties for dynamic response variability prediction*
- **Junghwan Kook** - *Topology optimization of acoustic problems using the hybrid finite element – wave based method*
- **Vicente Cutanda Henriquez** - *Numerical modelling of acoustic metamaterials including viscous and thermal losses*
- **Peter Risby Andersen** - *Numerical modelling of acoustic viscous and thermal losses*
- **Hansotto Kristiansen** - *Acoustic black holes and 3D polymer printing*

12.00-12.45: Sandwich lunch

12.45-13.35: Micro-manufacturing and materials:

- **Saeed Doagou Rad** - *Nano-filled polymers for thin-walled micro components*
- **Timea-Denisa Merca** - *Injection mouldable conductive plastics in hearing aid applications*
- **Aminul Islam** - *Highlights on the recent manufacturing activities*

13.35-13.50: Coffee & cake

13.50-14.25: Large-scale computations and nonlinear dynamics:

- **Suguang Dou** - *Optimization methods in nonlinear structural dynamics*
- **Niels Aage** - *Large scale modelling of indefinite problems*

14.25-14.30: Closing remarks

Please sign up with CAMM-coordinator Nadia Larsen (njl@elektro.dtu.dk) December 2nd at the latest.

Best regards
Jakob Søndergaard Jensen
Head of CAMM

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Ester Creixell Mediante: *Modelling mechanical contact uncertainties for dynamic response variability prediction*

Variability in the dynamic response of assembled structures arises due to uncertainties in the contact between the parts that conform them. A method to localize most probable contact areas, and determine the most sensitive contact points with respect to variations in the vibration response is presented. The method identifies the contact parameters by a gradient-based optimization procedure that updates a FE model to match collected experimental data. The probability distributions of the contact parameters are estimated from modelling the contact for several measured vibration responses.

Junghwan Kook: *Topology optimization of acoustic problems using the hybrid finite element – wave based method*

In this research, topology optimization using the Hybrid FE-WBM was developed to overcome disadvantages of element based methods, such as the finite element method (FEM) and the boundary element method (BEM), which are limited to lower frequencies due to high computational cost in acoustic analysis. Through this research, the analysis and topology optimization on large-scale problems requiring heavy computation at mid-frequencies would be possible.

Vicente Cutanda Henriquez: *Numerical modelling of acoustic metamaterials including viscous and thermal losses*

The presentation contains recent work shown at the 2015 International Conference on Theoretical and Computational Acoustics (ICTCA). An acoustic Boundary Element Method with viscous and thermal losses has been employed in the modelling of acoustic metamaterials, showing that losses have a critical impact on their performance. The simulation of acoustical metamaterials with losses is challenging in terms of computational load.

Peter Risby Andersen: *Numerical modelling of acoustic viscous and thermal losses*

Acoustic losses are often negligible but when the dimensions become small, losses play an important role. Acoustic devices, i.e. hearing aids and mobile phones, have the tendency to become smaller which drives the need for better numerical tools to capture the effect of viscous and thermal losses. This presentation will treat the subject of acoustical losses and the progress in the field enhancing the numerical methods.

Hansotto Kristiansen: *Acoustic Black Holes and 3D polymer printing*

This project contained two main objectives to be investigated. 1) Can acoustic black holes be used to damp vibrations in plates and shells, e.g. in hearing aids and 2) to what extend can we use the student 3D polymer printers at DTU Mechanics for reliable prototyping.

Saeed Doagou Rad: *Nano-filled polymers for thin-walled micro components*

Polymeric nanocomposites reinforced with carbon nanotubes have provided exceptional advantages for different engineering applications. This presentation introduces the application of these novel materials for the enhancement of different properties in high performance shells of hearing aids and the possible developments in this area through a coupled numerical and experimental approach.

Timea-Denisa Merca: *Injection mouldable conductive plastics in hearing aid applications*

Electrically conductive polymers combine the advantage of plastic processing with metal electrical properties, which make them attractive candidates in hearing aid antenna applications. The study was based on experimental testing, in order to determine the feasibility of the selected materials for this research.

Aminul Islam: *Highlights on the recent manufacturing activities*

The purpose of this presentation is to make an overview of the recent micro manufacturing activities at the Centre for Acoustic-Mechanical Micro Systems. Manufacturing research at the CAMM centre became quite diverse in a short span of time. The research activities comprise composite materials, electrically conductive plastics, precision powder moulding, fabrication of band gap structures etc. Application of the research results ranges from the loudspeaker cones to the frequency converter components, from the hearing aid antennas to the battery changing system, fuel cell components etc.

Suguang Dou: *Optimization methods in nonlinear structural dynamics*

Simple modifications of structures, such as beams of varying cross-section, may significantly alter the nonlinear dynamics of structures. Here, design optimization based on two different methods are presented. The IHB-method is used to control the fundamental character of nonlinearities (hardening/softening) and a new computationally cheaper pseudo-linear method is introduced to optimize nonlinear coefficients directly. Examples include micro/nano-mechanical resonators.

Niels Aage: *Large scale modelling of indefinite problems*

Solving hyperbolic problems such as the (indefinite) Helmholtz equation using iterative methods, and large scale computing, is currently impossible except in certain highly specialized cases. This talk concerns a recently developed preconditioner, which (hopefully) will pave the way towards solving mega-scale acoustic/mechanical problems in the frequency domain.