

CAMM Newsletter #5 – August 2016

We are very pleased to face many new students when the autumn semester starts in September – both on our courses but more importantly also with our many new master students. The increased awareness among the students of the CAMM activities is undoubtedly linked to our specialized CAMM courses that are attracting increasing numbers of students - so we definitely expect the positive development to continue in the coming semesters!

Selected upcoming activities are: 1) Special technical session on “**Hearing Aids**” during [4M 2016 conference](#) (September 13th-15th) organized by DTU MEK, 2) The planning of a new bachelor course on manufacturing, simulation and testing of small acoustic devices - planned to be launched in autumn 2017 and 3) Two CAMM PhD projects to be announced on topology optimization of acoustic-mechanical interaction problems.

Awards & Prices

Niels Aage attended the [PRACEdays16](#) conference from the 10th-12th May in Prague on “European collaboration on high performance computing”. The presentation resulted in an award for the “best industrial application” on the work of giga-scale structural optimization.



Ongoing PhD and postdoc projects

Ester Creixell Mediante, Industrial PhD at Oticon: Project title: “[Computational reduction techniques for numerical vibro-acoustic analysis of hearing aids](#)”

Supervisors: Jonas Brunskog, Martin Larsen (Oticon) and Jakob Søndergaard Jensen.

Project running: 2014 –2017

Current research activities:

- Two modal-based methods have been selected as suitable candidates for model reduction of problems with structure-acoustic interaction.
- For optimization purposes, those methods have been combined with a multi-model reduction approach that manages to speed up significantly parametric optimizations on the simplified hearing aid model.
- The applicability of the methods to cases with structural damping and surrounding air is being currently investigated.

Contact: *Ester Creixell Mediante*

Peter Risby Andersen, PhD student: “[Numerical and Experimental Study of the Acoustical-Mechanical Interaction at the Micro Scale including Losses](#)”

Supervisors: Vicente Cutanda Henriquez and Niels Aage.

Project running: 2015-2018

Current research activities:

- Development of a non-reduced formulation of the acoustic boundary element method. The benefit is enhanced stability but with the drawback of a larger system size.
- Development of a new combined finite and boundary element formulation for acoustic problems including viscous and thermal losses.

Contact: *Peter Risby Andersen*

Saeed Doagou Rad, PhD student: “[Experimental and Numerical Characterization of Nano-filled Polymers for Thin-Walled Micro Components](#)”

Supervisors: Aminul Islam and Jakob Søndergaard Jensen.

Project running: 2015-2018

Current research activities:

- Investigation of the effect of injection molding parameters on the mechanical and electrical properties of different contents PA6,6 / MWCNT nanocomposites in order to study their influence on the orientation and dispersion state of carbon nanotubes, and the level of crystallization of polymer system, which are characterized using DSC, TEM, SEM, etc.
- Finite element modeling of the debonding between CNT and polymer chains in the nanocomposites through implementation of the cohesive zone model in the contact algorithm of ANSYS.

Contact: *Saeed Doagou Rad*

Junghwan Kook, Assistant professor: Project title: “[Systematic Design of Bandgap Microstructure for Minituarized Acoustic-Mechanical Devices](#)”

Project running: 2015-2017

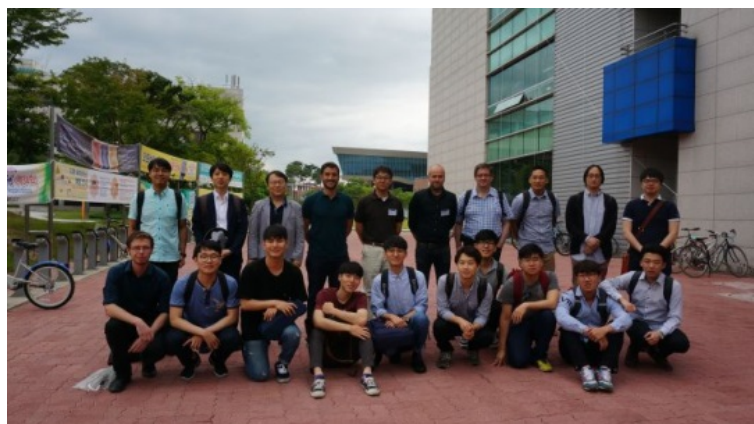
Current research activities:

- An experiment investigation of a finite structure was explored to study the total bandgap phenomenon in terms of acoustic and structural waves in the audible frequency range.
- A topology optimization method was developed to obtain a favorable non-planar plate design for maximizing the relative bandgap for both bending waves and acoustic waves in a certain frequency band.

Contact: *Junghwan Kook*

Travel & Visits

Vicente Cutanda Henriquez and **Junghwan Kook** visited the Korea Advanced Institute of Science and Technology ([KAIST](#)) at Daejeon, South Korea, in June, together with other staff from [Acoustic Technology](#), DTU. The purpose was initiating collaboration in acoustics, with special emphasis on numerical acoustics, room acoustics and acoustic metamaterials. During the visit, there was a two-day workshop with the participation of staff and students from KAIST and DTU, and many meetings aimed at giving form to this collaboration.



From the 1st of October, **Peter Risby Andersen** will be leaving for a six month external research stay at the [Technical University of Munich](#), under the supervision of Steffen Marburg. During the stay Peter will be attending courses on aeroacoustics and computational acoustics.

Ester Creixell Mediante is going on an external stay to KU Leuven (Belgium) from 1st September to 30th of November. She will be visiting the [Noise and Vibration Research Group](#) where she will collaborate with professors Desmet and Pluymers on the topic of reduction techniques for structural-acoustic problems.

Conferences

On 6-10th June, **Niels Aage** attended the [Frontiers in PDE-constrained Optimization](#) at the Institute for Mathematics and its Applications (IMA) in Minneapolis, USA.

Vicente Cutanda Henriquez has attended the [Euroregio](#) 2016 conference in Porto (Portugal) on 13th–15th June. Euroregio is a joint Iberian-European conference on acoustics. The work presented was entitled “*Numerical modeling of double-negative acoustic metamaterials: Should losses be included?*”.

Jakob Søndergaard Jensen attended the [ECCOMAS Congress 2016](#) - the world’s largest congress on computational mechanics on Crete, Greece, June 5th–10th, Jakob gave a presentation on “*Topology optimization in nonlinear structural dynamics using direct computation of nonlinear coefficients*”.

Junghwan Kook attended Asian Congress of Structural and Multidisciplinary Optimization 2016 ([ACSMO 2016](#)) held in Nagasaki, Japan, (22th–26th May). ACSMO 2016 is the first conference hosted by the Asian Society for Structural and Multidisciplinary Optimization (ASSMO) taking over the series of biennial symposia called the China-Japan-Korea Joint Symposium on Optimization of Structural and Mechanical Systems. Junghwan presented his current research on “*Topology Optimization for Bandgap Structure in Coupled Acoustic-Mechanical Micro System*”.

Peter Risby Andersen has attended the [EuroRegio](#) conference 2016 in Porto, Portugal (13th-15th June). During the conference Peter attended the EAA summer school course entitled “*Numerical methods in acoustics*”

Junghwan Kook attended the Europe-Korea Conference on Science and Technology ([EKC](#)) held in Berlin, Germany (27th–30th July 2016). Junghwan presented his current research on ‘*Investigation of Bandgap Structure in Coupled Acoustic-Mechanical System*’.

Ester Creixell Mediante, Junghwan Kook and **Vicente Cutanda Henriquez** will be attending [Internoise](#) 2016 (21–24 August) in Hamburg. Titles of the presentations are “*A Multi-Model Reduction Technique for Optimization of Coupled Structural-Acoustic Problems*”, “*Investigation of Bandgap Structure in Coupled Acoustic-Mechanical System*”, “*A numerical method for determining the radial wave motion correction in plane wave couplers*” and “*Static pressure and temperature coefficients of working standard microphones*”.

Niels Aage will attend the [International Conference on Theoretical and Applied Mechanics](#) in Montreal, Canada, (August 21th-26th) where he will present work on a robust design method for vibro-acoustic coupled topology optimization.

Aminul Islam will attend the 66th [CIRP](#) General Assembly in Guimaraes, Portugal from 21-27 August 2016.

Ester Creixell Mediante will attend the ISMA conference (19th–21st September) followed by the ISAAC course (22th & 23th September) in Leuven, which is organized every two years by the research group that she will be visiting. She has submitted a paper for the conference with the title “*Model reduction for optimization of structural acoustic coupling problems*” and will be giving a talk about it.

Aminul Islam will chair the technical Session-5 titled “**Hearing Aids**” during [4M 2016 conference](#) (Sep 13-15) to be organized by DTU MEK (section MPP).

In September (10th to 12th) **Niels Aage** will give an invited talk at [the European Conference on Computational Optimization](#) at KU Leuven, Belgium.

Saeed Doagou Rad will attend the [4M/IWMF](#) 2016 conference, (13th-15th September) in Lyngby, Denmark. He has submitted a paper entitled “*A conceptual framework for designing micro electrical connectors for hearing aid instruments*”, and he is going to present his paper at the “hearing aid” session in the first day of the conference.

Courses

In June, 36 students completed the second round of the CAMM course **41813: “FEMVIB” – finite element based vibration analysis and acoustic interaction**. The students came primarily from the master educations in “*Engineering Design and Applied Mechanics*” and “*Engineering Acoustics*” and included a few PhD students. We are looking forward to the third round starting February 2017 – and welcome industrial participants looking for a brush-up on finite element modelling of acoustic-mechanical interaction.

Contact: *Jakob Søndergaard Jensen/Niels Aage*

PhD Summer School 41790: The Ph.D. summer school on Micro Mechanical Systems Design and Manufacture was held from June 20th to July 1st 2016. There were about 20 students on the course and they worked with the development of a Biopolymeric Micro-Staples for Surgical Wound-Closing after Caesarean sections.

Contact: *Aminul Islam*

The 3-week course 41743: Micro Product Design, Development and Production course will be held again next year during January and this time in collaboration with GN Resound. The final course and project planning will be done during October-November 2016.

Contact: *Aminul Islam*

Numerical Acoustics 31265 - The second edition of the course will start in September with an initial count of 17 students, a significant increase from first edition’s six students. The course responsible is Vicente Cutanda Henriquez with the assistance of Junghwan Kook

Contact: *Vicente Cutanda Henriquez/Junghwan Kook*

A new bachelor course about manufacturing, simulation and acoustics of small mechanical devices is in the initial planning phase. The course will be run in collaboration with DTU MEK and DTU Electro and expected to commence for the first time during autumn 2017.

Contact: *Aminul Islam, Jakob Søndergaard Jensen*

New published papers

Journal paper titled “*Experimental Investigation of Comparative Process Capabilities of Metal and Ceramic Injection Molding for Precision Applications*” published in ASME Journal of Micro- and Nano-Manufacturing by Aminul Islam, Nikolaos Giannekas, David Marhöfer, Guido Tosello and Hans Hansen is available [here](#)

Contact: *Aminul Islam*

The journal paper “*Optimization of directional elastic energy propagation*” published in *Journal of Sound and Vibration* is available [here](#).

Contact: *Jakob Søndergaard Jensen*

The journal paper “*Inertial amplification of continuous structures*” published in *Journal of Applied Physics* is available [here](#).

Contact: *Jakob Søndergaard Jensen*

The journal paper “On nanostructured silicon success” published in *Nature Photonics*.
Contact: Jakob Søndergaard Jensen

The journal paper “A practical multiscale approach for optimization of structural damping” published in *Structural and Multidisciplinary Optimization* is available [here](#).
Contact: Jakob Søndergaard Jensen

Journal paper titled “[Improving topology optimization intuition through games](#)” published in *Structural and Multidisciplinary Optimization*, online first, 2016.
Contact: Niels Aage

Journal paper titled “[Large scale three-dimensional topology optimisation of heat sinks cooled by natural convection](#)” published in *International Journal of Heat and Mass Transfer*, vol. **100**:876-891, 2016.
Contact: Niels Aage

Journal paper titled “[On the \(non-\)optimality of Michell structures](#).” published in *Structural and Multidisciplinary Optimization*, vol **54**:361-373, 2016.
Contact: Niels Aage

Master projects

DTU master student **Xiaoliu Li** has successfully defended her master project on July 27, 2016. The title of the project was “*3D Simulation and experimental validation of hearing aid shells with the Moldex3D simulation software*” which ran in collaboration with [Widex](#) within the period of Feb 15, 2016 to July 15, 2016.

Contact: Aminul Islam

Anders Lilje Møller is starting his MSc thesis on electro-vibro-acoustic coupled topology optimization. The project runs from August 22th to January 2017 with Jakob Søndergaard Jensen as co-supervisor.

Contact: Niels Aage

Alexander Hvid Jessen will start a new master project in collaboration with [Widex](#) (Lars Friis) on “*Topology optimization of sound pressure generated vibrations*”. Alexander will spend the fall semester in Canada and start the project when he returns.

Contact: Jakob Søndergaard Jensen

Another master project is planned in collaboration with [Widex](#). **Jens Mørup**, a DTU master student will be working in the area of Teleaudiology and the project is expected to be started from the beginning of September 2016.

Contact: Aminul Islam

A new master project is going to be started in collaboration with [Dentawi ApS](#). DTU student **Lisa Rabenow** will work in the project to develop a novel manufacturing method for the production of artificial human teeth. The project will be ended by December 2016.

Contact: Aminul Islam

Kristian Wissing & Kristian Ravnborg are doing their MSc thesis on large scale structural optimization of container ship hatch covers in collaboration with [Mærsk Maritime Engineering](#). The project runs from August 22th to January 2017.

Contact: Niels Aage

Nicolas Phillippe Lehman is starting his MSc thesis on large scale topology optimization of flow machinery. The project runs from August 22th to January 2017 with Casper Andreasen as co-supervisor.

Contact: Niels Aage

Paw Møller is starting his MSc thesis on detection, characterization, and FEM-modeling of localized structural nonlinearity. The project runs from August 22th to January 2017 with Jon J. Thomsen as main-supervisor in collaboration with Dmitri Tcherniak from [B&K](#).

Contact: Niels Aage

Simon Dyring Larsen is starting his MSc thesis on shape and topology optimization of complex truss and frame structures. The project runs from August 22th to January 2017 with Ole Sigmund as main-supervisor.

Contact: Niels Aage

Bachelor projects

Johs Kirkelund Madsen successfully defended his bachelor project on impact tests of hearing aids receivers. The project ran in collaboration with GN Resound (Yu Luan and Gojko Abradovitch).

Contact: Jakob Søndergaard Jensen

Hjalmar Danielsen is starting his Diploma thesis on Modelling, measurements and experimental setup for natural convection cooled LEDs. The project runs from August 29th to January 2017 with Boyan Lazarov as co-supervisor.

Contact: Niels Aage

Internship student

Tiberio Giovanni is going to start as an internship student at CAMM. He is going to do some more in-depth investigation on some of the unsolved issues from his master project which was done last year on "*Feasibility Study of Alternate Materials and Manufacturing Methods for Superior Performance of the Loud Speaker Cones*".

Contact: Aminul Islam

Grant applications

Grant application to the Villum Foundation's Young Investigator Program on coupled electro-acoustic-mechanical interaction: modelling, large scale realization and shape and topology optimization.

Contact: Niels Aage

Guests & Visitors

Abdelkhalik ELadi has started as a guest PhD student from August 1st, 2016. He is from the Production Engineering and Mechanical Design Department, Mansoura University, Egypt. Abdelkhalik will be spending 2 years at DTU as part of his Ph.D work. He has received financial assistance from Bureau of Cultural and Educational Affairs of Egypt for his stay at DTU. His work at DTU will focus on the precision micro moulding and will be supervised by Aminul Islam and Guido Tosello from DTU.

Contact: Aminul Islam

PhD student **Milad Saadatmand** from Iran will visit CAMM for a period of 6 months from September – February 2017. His project is titled "*Nonlinear vibration and control analysis of two-sided condenser micro-plate in presence of electrostatic and Casimir forces*".

Contact: Jakob Søndergaard Jensen

Postdoc **Suguang Dou** from University of Liege will visit CAMM for a period of 3 months from October – December 2016. His project deals with topology optimization of nonlinear vibrations.

Contact: Jakob Søndergaard Jensen

Professor **Wonju Jeon**, from the Korea Advanced Institute of Science and Technology ([KAIST](#)) will pay a two-day visit to DTU on 25th-26th August. This is a follow-up of the collaboration actions mentioned regarding the travel to KAIST by some CAMM and other DTU staff mentioned in this newsletter.

Contact: Vicente Henriquez

Miscellaneous

Saeed Doagou Rad along with his supervisor **Aminul Islam** supervised two groups of students in the two three-week courses in the Mechanical Engineering department at DTU in June and August 2016. The project entitled “Comparative study of the mechanical properties of the injection moulded green metal and ceramic parts” was successfully completed in the “Project course in metalworking processes (41709)”. In addition, the project named “The effect of humidity on the mechanical properties of polymeric nanocomposites reinforced with multi-walled carbon nanotubes” was also successfully accomplished in the course titled “Experimental Plastics Technology (41972)”.

A 3 week special course on “The finite element method for vibration analysis” was successfully carried out in June 2016.

Contact: Junghwan Kook

Junghwan Kook launched a warm-up project collaborating with KAIST. This collaboration will develop Reliability Based Acoustical Topology Optimization with acoustical uncertainties.

Macarena Méndez will start an experimental **special course** from the beginning of September. During the course she will work on the development of new production methods for loud speaker cone based on thermoforming process.

Contact: Aminul Islam

Three special projects are running in the fall semester (13 week period)

“Contact modelling, acoustic coupling and structural optimization” (**Hansotto Kristiansen**)

“Wave loads on off-shore structures and structural optimization” (**Brit Sehested Nissen**)

“Large scale topology optimization in PETSc using shell elements” (**Daniel Gert & Søren Pedersen**)

Contact: Niels Aage

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