

Mid-frequency Analysis of Noise and Vibration

Report on

Professional Development Course 1 (PD1) and Industrial Workshop 2 (IW2)

St Anne's College, Oxford, 5-7 April 20

These two events were held consecutively at St. Anne's College, Oxford. PD1 and IW2 formed deliverables D9.6 and D9.5 respectively of the Mid-Mod project. PD1 was held on April 5-6, while IW2 ran on April 6-7. The programmes for the two events are attached. Between them they covered a wide range of topics and applications in the general area of mid-frequency analysis of noise and vibration, with the talks presented by consortium members. The two events were preceded by a "Refresher Course" (RC) on Monday April 4 (programme attached). A delegate list is also attached.

Motivation and Programmes

The courses were held consecutively, to optimise travel times and costs for the delegates, many of whom attended both PD1 and IW2.

PD1 emphasised methods and techniques. Following an introduction and welcome, an overview of mid-frequency issues was presented. This was followed by 9 talks describing specific technical approaches and methods in some detail.

IW2, on the other hand, emphasised application to industrial problems. There was again an introduction and welcome, followed by 9 technical presentations, illustrating the application of the methods described in PD1.



PD1 and IW2 were conducted informally – questions were welcomed at any time, there were many discussion periods, and the timing was flexible.

RC was held on April 4 prior to PD1 and IW2. It comprised 7 technical talks and a general introduction. The aim was to review background material that is prerequisite for PD1 and IW2: it brought delegates, who might be experienced in only one or two facets of noise and vibration analysis, up to speed with the whole range of techniques appropriate to the mid-frequency regime. Again there were many question and discussion sessions.

Attendance

In total 52 delegates attended some part of the week. Of these 24 were members of the Mid-Mod consortium, 17 were from partner organisations but not involved with Mid-Mod and 11 were external to Mid-Mod. One delegate attended from each of the USA and PRC, with the rest from Europe. 19 were from industry, 30 from academia and 3 from research establishments.

The RC was attended by 26 people (including speakers), PD1 by 39 and IW2 by 39. Of these 26 attended both PD1 and IW2.



Comments

The meetings were residential, with delegates living, sleeping and eating in hall. This made for an intense week, with delegates being able to discuss issues – both about and around the subjects of the talks – from breakfast to bedtime. The college bar was opened shortly before dinner each night, to enable delegates to meet, have a pre-prandial drink and walk in to dinner together.

The length and depth of all 3 meetings seemed about right from informal feedback. The courses were well received, although no formal surveys were taken. The residential nature gave benefits far beyond merely attending 4 days of talks: delegates could meet, exchange experiences and discuss a broad range of issues.



The presentations are available on the public pages of the Mid-Mod web site (www.midmod.eu).

B R Mace

16 June 2011

Mid-frequency Analysis of Noise and Vibration

Refresher Course programme
St. Anne's College, Oxford, 4 April 2011

Venue: Tsuzuki Lecture Theatre, Ruth Deech Building

09:30 Registration in Foyer A, Ruth Deech Building

10:00 Course commences

- Introduction and welcome (*Prof Brian Mace, ISVR, University of Southampton*)
- Overview: what do we mean by "low" and "high" frequency? (*Prof Brian Mace, ISVR, University of Southampton*)
- Modes of vibration: multiple degree of freedom systems (*Prof Brian Mace, ISVR, University of Southampton*)

Coffee/tea

- The modal behaviour of structures (*Dr Neil Ferguson, ISVR, University of Southampton*)

12:30 Lunch

13:30 Course recommences

- Wave motion in structures (*Dr Neil Ferguson, ISVR, University of Southampton*)
- Finite element analysis (*Prof Wim Desmet, K U Leuven*)

Coffee/tea

- Numerical methods in acoustics (*Prof Wim Desmet, K U Leuven*)
- Statistical energy analysis (*Dr Mathias Barbagallo, Svante Finnveden, KTH*)
- Discussion (*Dr Neil Ferguson, ISVR, University of Southampton*)

Close approximately 17:30

18:15 Pre-dinner drinks, St Anne's College bar

19:00 Dinner

Mid-frequency Analysis of Noise and Vibration

Professional Development Course
St. Anne's College, Oxford, 5-6 April 2011

Venue: Tsuzuki Lecture Theatre, Ruth Deech Building

09:30 Registration in Foyer A, Ruth Deech Building

10:00 Course commences

- Introduction and welcome (*Prof Brian Mace, ISVR, University of Southampton*)
- Overview: structural dynamics at low, high and mid frequencies (*Prof Brian Mace, ISVR, University of Southampton*)
- Recent advances in FEM & BEM acoustics for mid-frequency applications, (*Dr Hadrien Beriot, Dr Stijn Donders, LMS International*)

Coffee/tea

- Accelerating the convergence of fast multipole BEM, (*Roberto D'Amico, Alessandro Pratellesi, Università degli Studi di Firenze*)
- Stochastic BEM: development of the formulation, basic assumptions and applicability to industrial problems, (*Alessandro Pratellesi, Roberto D'Amico, Università degli Studi di Firenze*) Discussion (*Dr Bert Pluymers, K.U.Leuven*)

12:45 Lunch

14:00 Course recommences

- Wave Based Modelling for vibro-acoustics: basic principles and examples, (*Dr Bert Pluymers, K.U.Leuven*)
- Wave based method for 3D unbounded problems, (*Jan Rejlek, Virtual Vehicle Research and Test Center*)

Coffee/tea

- Wave and Finite Element method and applications, (*Prof Brian Mace, ISVR, University of Southampton*)
- Discussion (*Dr Ulf Orrenius, Bombardier Transportation*)

Close approximately 17:30

18:15 Pre-dinner drinks, St Anne's College bar

19:00 Dinner

09:00 *Wednesday April 6, course recommences*

- Coupled FE-SEA modelling, (*Dr Phil Shorter, ESI, Dr Ulf Orrenius, Bombardier Transportation*)
- Sound transmission through multilayered structures including porous viscoelastic materials, (*Dr Mathias Barbagallo, Prof Svante Finnveden, KTH.*)

Coffee/tea

- Aspects of computational aeroacoustics and applications at Volkswagen, (*Dr Wim De Roeck, KU Leuven/ Volkswagen*)
- Discussion and close (*Dr Stijn Donders, LMS International*)

Close approximately 12:30

12:30 *Lunch*

Mid-frequency Analysis of Noise and Vibration

Industrial Workshop
St. Anne's College, Oxford, 6-7 April 2011

Venue: Tsuzuki Lecture Theatre, Ruth Deech Building

12:30 Lunch

13:45 Registration in Foyer A, Ruth Deech Building

14:00 Course commences

- Introduction and welcome (*Prof Jan-Welm Biermann, Sven Ruschmeyer, RWTH Aachen University*)
- Experimental and numerical two-port characterization of a truck exhaust muffler, (*Dr Wim De Roeck, K.U.Leuven/Volvo.*)
- Numerical investigation on the noise radiation of a truck exhaust muffler, (*Jan Rejlek, Virtual Vehicle Research and Test Center.*)

Coffee/tea

- Signal horn: modelling and optimization by means of FMBEM and measurements, (*Roberto D'Amico, Adam Galezia, Università degli Studi di Firenze and SIMR.*)
- Discussion (*Sven Ruschmeyer, RWTH Aachen University*)

Close approximately 17:30

18:15 Pre-dinner drinks, St Anne's College bar

19:00 Dinner

09:00 *Thursday April 7, course recommences*

- On the use of a Hybrid Wave Based - Finite Element model for vehicle interior acoustic analysis, (*Dr Bert Pluymers, K.U.Leuven/Volkswagen.*)
- Mid-frequency simulation & testing for interior truck acoustics applications, (*Dirk von Werne, Dr Stijn Donders, LMS International.*)

Coffee/tea

- Approaches for mid-frequency testing related to automotive acoustic applications, (*Sven Ruschmeyer, Adam Galezia, RWTH Aachen University/SIMR.*)
- Discussion (*Prof Jan-Welm Biermann, RWTH Aachen University*)

12:00 *Lunch*

13:00 *Course recommences*

- Examples of BEM applications to mid frequency problems in the automotive industry, (*Marco Danti, Rosario Raniolo, Fiat Group.*)
- Coupled FE-SEA: industrial applications, (*Dr Ulf Orrenius, Bombardier Transportation.*)

Coffee/tea

- Application of the WFE method to rail structures, (*Dr Jamil Renno, ISVR, University of Southampton.*)
- Discussion and close (*Carl Fredrik Hartung, Volvo Technology*)

Close approximately 16:00

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Delegate List

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