MAKUNET (NETVÆRK FOR MASKINAKUSTIK)

Seminar

'Passive control of vibration using the Acoustic Black Hole (ABH) effect'

Date: Thursday 14 June 2018
Time: 10:00 – 15:15
Place: Aalborg University, Department of Materials and Production, Fibigerstræde 16, room 111

PROGRAM

10:00-10:20 **Coffee/tea**
10:20-10:30 **Welcome *(Professor Sergey Sorokin, DMP AAU)***
10:30-12:00 **Part 1: the ABH principle and modeling – *a lecture by Professor Francois Gautier, LAUM, University of Le Mans, France***
12:00-12:45 **Lunch**
12:45-14:15 **Part 2: Experimental evidence and characterization of the ABH effects – *a lecture by Professor Adrien Pelat, LAUM, University of Le Mans, France***
14:15-14:30 **Discussion**
14:30-15:15 **Presentations of students' projects**

The ABH principle and modeling

Professor Francois Gautier
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Acoustic Black Hole (ABH) are wave traps used to passively control the vibrations of structures. Such a wave trap embedded in a thin walled structure consists in a tapered indentation of power-law profile, covered by a thin visco-elastic layer. Such local variations of the bending stiffness and surface density leads to a gradually decreasing phase velocity and a gradually increasing local loss factor towards the ABH center. It is shown that such an Acoustic Black Hole is an efficient vibration damper. The number of papers studying this device is growing since the first works on this field in the 80's ; These papers show that several properties are usually observed in an ABH : low reflection coefficient, localised vibration, trapped modes, cut-off frequency, band gaps when a grid of ABH is organized periodically. Models of various ABH configurations are developed using geometrical acoustics, multimodal expansion, wave approach, finite difference method.

The aim of this talk is to provide a state of the art on the ABH properties and to illustrate them by presenting modeling of different classes of 1D (beam) and 2D (plate) configurations.

Experimental evidence and characterization of the ABH effect

Professor Adrien Pelat
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A collection of demonstrators of different kinds have been developed at LAUM in order to evaluate the performance of the ABH strategy. For this purpose, investigations are performed on 1D and 2D ABH of various types; 1D ABH with varying thickness only, 1D ABH with varying thickness and width, non linear 1D ABH, 1D ABH with local defects, slots, circular 2D ABH with and without central hole, circular 2D ABH with and without central masses, periodic lattice of 2D ABH embedded on a flat panel. The capability of these different configurations to damp vibrations is discussed.

The aim of this talk is to provide experimental evidence of the efficiency of the ABH effect and illustrate how the ABH strategy can be applied in industrial contexts related to mechanical engineering. In 1D ABH configuration, measurement of the reflection coefficient is performed to characterize the termination. In 2D, direct measurements of vibratory fields and vibratory imagings are clearly showing the reduction of the vibration due to the trap effect.

The hand-outs of the lecture will be distributed among the participants

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Tilmelding skal ske til Professor Sergey Sorokin, Institut for Materials & Produktion, AAU, Fibigerstræde 16, 9220 Aalborg. Helst via e-mail svs@m-tech.aau.dk , senest den. 12 juni