9-11 April 2018
BESANÇON - FRANCE

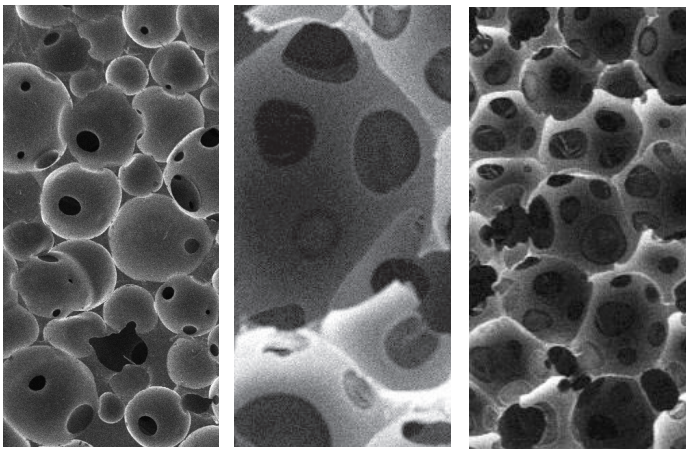
FEMTO-ST INSTITUTE
Amphithéâtre J.-J. Gagnepain
15B Avenue des Montboucons
25030 Besançon

3rd VIPER SPRING SCHOOL

VIBROACOUSTICS OF POROELASTIC MATERIALS

SCOPE

Poroelastic materials are key components of soundpackages: they make it possible to produce lightweight, efficient and easily industrializable devices. The understanding of the physical phenomena governing the propagation of elastic and acoustic waves within these materials allows their optimal arrangement, leading to the desired dissipation of energy. This spring school aims at providing basic concepts describing acoustic and elastic waves propagation in poroelastic materials, the more pertinent models and associated numerical implementations, the characterization techniques, up to advanced system designs and industrial applications. During three days, lectures will be given by world specialists of this field of research, from fundamental bases to industrial concerns. The spring school is open to audience of MSc and PhD students, engineers and researchers interested in vibroacoustics of poroelastic materials.



PARTICIPATION

Participations from both the academia and the industry are welcome.

Maximum number is 50.

Registration fees : 150 euros, including: coffee breaks, lunchs and course supports.

Deadline for registration : 25th March 2018

VIPER

VIPER is a European Joint Doctorate on Vibroacoustics. VIPER aims at consolidating academic research dealing with VIbroacoustics of PERiodic media. Structural periodic design is a powerful strategy for lightweight structures achievements while remaining a convenient solution for manufacturing guidelines aspects. Including vibroacoustic design rules at early stage of products development is one of the main research targets. Periodic media exhibit proper dynamic filtering effects that can be smartly used for vibroacoustic design. The question addressed then is simple: how periodic concepts can improve the broadband vibroacoustic signatures and performances? Most of vibroacoustic treatments are frequency band limited. Indeed, on the one hand, viscoelastic materials (for instance) can be used for low frequency passive vibration control. On the other hand, poroelastic blankets are efficient for high and mid frequency absorption of acoustic disturbance. Newly and extensively employed lightweight structures present a strong dynamical overlapping between low, mid and high frequency bands that needs to be dealt with.

The VIPER project' main goal is to develop and to validate tools for the design of global vibroacoustic treatments based on periodic patterns allowing passive control of vibration and acoustic paths in layered concepts. This will be achieved by addressing in-depth structural periodicity stiffness as well as absorption attributes. The proposed concepts would ensure a significant improvement of vibroacoustic performances in a wide frequency range. Dealing with large scale periodic structural-acoustic concepts involves a multi-scale aspect that needs specific numerical tools. A two scale strategy will be pursued in most of the achievements to handle periodicity effects: the meso-scale is related to the elementary cell or the span, while the macroscale relates to the full-size structure. Each scale will be characterized by its own efficiency indicators: effective parameters (mechanical and acoustical equivalent material properties, dispersion characteristics...) at the meso-scale, and vibroacoustic indicators (structural damping, acoustic absorption, transmission loss...) at the macro-scale.

CONTACT

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REGISTER NOW at http://www.femto-st.fr/fr/Agenda/agenda-2018/Viper-Spring-School/

European Commission

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SPEAKERS

PROGRAM

9/4/18 PM	Introduction & models Luc Jaouen / Matelys Inc., FR
10/4/18 AM	Numerical methods for porous materials Noureddine Atalla / U. Sherbrooke, CA
10/4/18 PM	Experimental techniques for porous materials Nicolas Dauchez / U.T. Compiègne, FR
11/4/18 AM	Periodic resonant structures for sound absorption and insulation Jean-Philippe Groby / U. Le Mans, FR
11/4/18 PM	Industrial applications Arnaud Duval / Trèves Inc., FR

LUC JAOUEN
Matelys Inc., FR

Introduction & models
This talk introduces the work on acoustical porous media modeling from the work by Henri Darcy to the latest Biot formulations. The main models, their parameters and limitations are presented and discussed in a didactic way. The modeling of perforated plates & acoustic facings, considered as thin porous materials is also discussed.
This talk ends by introducing some perspectives related to materials & models or theories.

NOUREDDINE ATALLA
Université de Sherbrooke, CA

Numerical methods for porous materials
This introductory course presents classical numerical models used to assess the performance of sound packages in general and porous materials in particular. The course will be divided into three parts. The first will recall the principle of the transfer matrix method, its implementation, extension and use. The second will deal with FE based methods. And the third will discuss applications including use of hybrid methods and periodicity principles.

NICOLAS DAUCHEZ
Université de Technologie de Compiègne, FR

Experimental techniques for porous materials
The lecture will first present the experimental techniques used in laboratories to determine the parameters characterizing a poroelastic material. These parameters are related to the fluid/skeleton coupling, viscous or thermal dissipation, and to the viscoelasticity of the skeleton. Both non acoustical and acoustical methods and their limits will be addressed. Then, experimental methods to evaluate the efficiency of a sound package will be presented: sound absorption and insulation using ducts, reverberant rooms, or field synthesis. Results obtained on polymer foams, fibrous or granular materials will be given.

JEAN-PHILIPPE GROBY
Le Mans Université, FR

Periodic resonant structures for sound absorption and insulation
This introduction lecture aims at providing a common knowledge as well as presenting more recent advances in the design of periodic and deep-subwavelength structures involving porous materials and more generally visco-thermal losses for sound absorption and insulation. Therefore, this lecture will be divided in three interconnected parts. First, some basic features will be recalled on acoustic diffraction gratings. Second, physical mechanisms of metaporous and metaporoelastic layers for sound absorption as well as resonant sonic crystals for sound insulation will be introduced. In the last part, deep-subwavelength structures for sound control will be presented, taking advantages of the critical coupling condition which provides physical insights of the impedance matching condition for both reflection and transmission problems.

ARNAUD DUVAL
Trèves Inc., FR

Industrial applications
Optimizing porous noise treatments requires understanding the sources characteristics and their transfers as well as identifying which dissipation mechanisms one should foster: absorption, insulation or vibration damping? For the latter phenomena improvements, a link between the ideal porous media properties and a feasible porous standard or meta-material has to be built using micro-macro approaches for example. In order to determine these feasible microstructure morphological changes, it is necessary to understand deeply what each manufacturing process permits to control. A review of these various porous media manufacturing processes and potential associated process simulations, as well as experimental and numerical optimization techniques will be presented and discussed.