Introduction to the special issue on acoustics of porous media

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The acoustical properties of porous media have been a subject of extensive research since the late 19th century. This theory has been adopted widely by various research communities to explain the acoustical behavior of porous absorbers used in noise control applications, porous sediments in ocean acoustics, porous rocks in geophysics, porous ground in outdoor sound propagation, and porous bones in medical ultrasound. In the last 20 years, this subject continued to attract considerable interest that has resulted in a very large number of publications in acoustics related journals. Special journal issues have appeared starting with the 1993 *Journal of Applied Acoustics* special issue on Sound Absorbing Materials that was organized by Professor Keith Attenborough. Subsequently, two more special issues have been published in the *Journal of Applied Acoustics* on innovative applications of acoustic [porous] materials in 2003 and in the *Journal of Acustica United with Acta Acustica* in 2010 on acoustics of porous materials organized by Professor Kirill Horoshenkov, Dr. Francois-Xavier Becot, and Dr. Luc Jaouen.

The idea of this special issue of the *Journal of the Acoustical Society of America* (JASA) was conceived at the Symposium on the Acoustics of Poro-Elastic Materials in Ferrara (Italy) in December 2011 that was also attended by the JASA editor in chief, Professor Allan Pierce. This has been an attempt to promote research on acoustics of porous media and bridge the barriers between research communities who make use of the related theory, numerical models, and experimental methods for the benefit of various other science and engineering disciplines. Therefore the main objectives for this issue are (a) to present the most up-to-date developments in the research related to acoustics of porous media, (b) to illustrate those areas of science to which this research subject is directly relevant, and (c) to illustrate challenges to this subject area that are yet to be addressed.

This issue is a compilation of 22 papers; this makes it the largest special issue on acoustics of porous media published so far. These papers contribute to new theoretical and numerical models and present new experimental evidence on sound propagation phenomenon in porous media, new experimental methods, and instruments for porous material characterization in the laboratory and *in situ*. The issue presents work on new relations between the non-acoustical and acoustical properties, effects of inhomogeneities, pore stratification, and mechanical properties of the elastic frame on sound propagation in a porous medium. More specifically, the presented papers cover a wide range of aspects related to modeling and experimental characterization of metamaterials with internal resonators, naturally occurring porous media with rather complex pore structure, porous media exposed to very high levels of acoustic excitation, porous media with a dissipative elastic frame, materials with partially connected pores, external roughness, and microperforations. This issue also presents new numerical modeling tools that enable us to predict sound propagation more efficiently in time and frequency domains and for more complex porous medium arrangements and to link these results more directly to the porous medium micro-structure.

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