**Acoustic Metamaterials and Metasurfaces: Fundamentals and Applications**

# Badreddine ASSOUAR

Institut Jean Lamour, University of Lorraine – CNRS, Nancy, France

# Abstract

I will provide an overview on recent researches on acoustic and elastic metamaterials and metasurfaces for sound/vibration isolation and acoustic energy harvesting we are developing in our group in the University of Lorraine. I first will present some advances related to low-frequency acoustic and vibration shielding/absorption making use of metamaterials1,2 and metasurfaces3,4, and describe the added value that such artificial engineered materials can bring to consider some innovative applications. Findings on both acoustic and elastic waves will be presented. Second, I will introduce and delineate the concept of acoustic energy harvesting based on metamaterials5 and metasurfaces6, the associated configurations and designs and the expected functionalities. The purpose of this seminar is to highlight the new properties/functionalities and applications the metamaterials in general are enabling and the emerging concrete applications they are generating.

1. M. B. Assouar, M. Senesi, M. Ruzzene & Z. Hou. Appl. Phys. Lett., 101 (2012) 173505.
2. J. H. Oh & M. B. Assouar. Scientific Reports, 6 (2016) 33410.
3. Y. Li & M. B. Assouar. Appl. Phys. Lett., 108 (2016) 063502. Highlighted by [AIP,](https://publishing.aip.org/publishing/journal-highlights/absorbing-acoustics-soundless-spirals) [Phys.org](http://phys.org/news/2016-02-absorbing-acoustics-soundless-spirals.html) ...
4. M. B. Assouar, B. Linag, Y. Wu, Y. Li, J-C. Cheng & Y. Jing. Nature Reviews Materials 3, (2018).
5. S. Qi, M. Oudich, Y. Li & M. B. Assouar. Appl. Phys. Lett., 108 (2016) 263501.
6. S. Qi, Y. Li & M. B. Assouar, Phys. Rev. Applied, 7 (2017) 054006.

# Bio

Badreddine Assouar received his PhD degree in Materials Physics from Nancy University in France in 2001. In 2002, he became a Research Scientist at the “Centre National de la Recherche Scientifique (CNRS)” in France. He obtained his accreditation to supervise research (HDR) in 2007 and became a Research Professor. In 2010, he joined Georgia Institute of Technology in USA as visiting Professor, where he spent 2 years. Since 2012, he leads the “Acoustics Metamaterials and Phononics” group at the University of Lorraine, where he is developing researches on acoustic/elastic metamaterials, metasurfaces and phononics. B. Assouar is Associate Editor of “JASA”, “Journal of Applied Physics” and “Scientific Reports”. He is also an expert scientist with the National Science Foundation (NSF-USA). He is author or co-author of more than 100 international peer reviewed international publications. His research interests are in the areas of acoustic and elastic metamaterials, metasurfaces, phononics and energy harvesting.