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TITLE: Influence of porosity, fiber radius and fiber orientation on anisotropic transport properties of random fiber structures

AUTHORS/INSTITUTIONS: H. Luu, R. Panneton, Groupe d'Acoustique de l'Université de Sherbrooke (GAUS), Département de Génie Mécanique, Université de Sherbrooke, Sherbrooke, Quebec, CANADA|C. Perrot, Laboratoire Modélisation et Simulation Multi Echelle, MSME UMR 8208 CNRS, Université Paris-Est, Marne-la-Vallée, FRANCE|

ABSTRACT BODY:

Abstract (200 words): The ability of fibrous media to mitigate sound waves is controlled by their transport properties that are themselves greatly affected by the geometrical characteristics of their microstructure such as porosity, fiber radius, and fiber orientation. Here, the influence of these geometrical characteristics on the anisotropic transport properties of random fiber structures is investigated. First, representative elementary volumes (REVs) of random fiber structures are generated for different triplets of porosity, fiber radius and fiber orientation. The fibers are allowed to overlap and are motionless (rigid-frame assumption). The fiber orientation is derived from a second order orientation tensor. Second, the transport equations are numerically solved on the REVs which are seen as periodic unit cells (PUCs). These solutions yield the transport properties governing the sound propagation and dissipation in the respective fibrous media. These transport properties are the tortuosity, the viscous and thermal static permeabilities, and the viscous characteristic length. Finally, relations are proposed to estimate the transport properties and the thermal characteristic length when the geometry of the fiber structures is known.

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PRESENTER: Camille Perrot

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AUTHORS (ADDRESS & EMAIL):

Name: Hoang Tuan Luu
Address 1: Groupe d'Acoustique de l'Université de Sherbrooke (GAUS)
Address 2: Département de Génie Mécanique
City: Sherbrooke
State: QC
Postal Code/Zip: J1K 2R1
Country: Canada
E-mail: hoang.tuan.luu@usherbrooke.ca

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Name: Camille Perrot
Address 1: Université Paris-Est Marne-la-Vallée, Laboratoire MSME UMR 8208 CNRS
Address 2: 5, Boulevard Descartes
City: Champs-sur-Marne
State:
Postal Code/Zip: 77454
Country: France
E-mail: camille.perrot@univ-paris-est.fr

****

Name: Raymond Panneton
Address 1: 2500 Universite Blvd.
Address 2: (none)
City: Sherbrooke
State: QC
Postal Code/Zip: J1K 2R1
Country: Canada
E-mail: raymond.panneton@usherbrooke.ca

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