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The Effect of Viscosity on the Propagation of Acoustic Waves Through Fine Cylindrical Meshes

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The generic problem of the viscous drag associated with the propagation of acous tical waves through cylindrical mesh structures is solved. At low acoustic Reyn olds numbers based upon the cylinder diameter and the acoustical velocity, the t otal drag results from the combination of the drag associated with propagation a long the axis of the cylinder and the drag associated with propagation normal to the axis of the cylinder. For the former, rather than considering waves propag ating over isolated cylinders, as considered by previous authors, we consider th e case of propagation within a channel bounded by polygonal periodic boundaries with a cylinder at the centre. This is a more realistic description of the real situation and the effects of the high order circumferential modes impli ed by this are shown to be second order but noticeable at low frequencies. Each of these is linear and thus arbitrary geometries can be considered. In this pa per we develop a theory which is valid in the limit of unsteady low Reynolds num ber acoustical flow and use this to consider the effect of geometry on the acous tical drag, and hence the acoustical absorption.

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