POROUS MATERIAL CHARACTERIZATION WITH BAYESIAN PARAMETER ESTIMATION

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ABSTRACT

A method to estimate the physical parameters of rigid-frame porous materials through measurement of the acoustic impedance of such materials is presented. Porous materials are widely used as sound absorbers in many industries. Modeling the effects of porous absorbers and making optimal use of porous absorbent materials requires knowledge of the physical parameters characterizing such materials: porosity, tortuosity, and flow resistivity. For many materials, direct measurement of these parameters requires time-consuming or highly sensitive procedures. Based on some existing models for the characteristic impedance of a porous material in terms of the physical material parameters, Bayesian parameter estimation is used to estimate the physical parameters of a material from a measurement of its complex acoustic impedance. In addition to estimation of the values of the physical parameters, Bayesian analysis generates information on the uncertainties and interdependence of the parameters. The results obtained are compared to published data for several rigid-frame porous materials.