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Advances in the microstructure and transport properties of random fibrous materials

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This paper gives an update on recent results obtained in the field of prediction of the transport properties of fibrous media from the characterization of their microstructures. (1) The first stage of this work deals with the development of a procedure for the reconstruction of the three-dimensional geometry of the random fibrous medium and its experimental validation [J. Acoust. Soc. Am. 141, 4768 (2017)]. (2) In a second step, the proposed model is used to calculate the associated transport parameters over a wide range of variation of the geometric parameters. Correlations are proposed to approximate these properties when the geometry of the fibrous medium is known [Acta Acust united Ac. 103, 1 (2017)]. (3) In the third step, the possibility of substituting a polydisperse distribution of fiber diameters by an equivalent monodisperse one is examined numerically [J. Acoust. Soc. Am. 141, EL96 (2017)]. (4) Finally, a fully stochastic methodology is proposed enabling to handle for complex fibrous media presenting both a wide distribution of fiber diameters and fiber lengths.