Society of Engineering Science 51st Annual Technical Meeting

1–3 October 2014

Purdue University, West Lafayette, Indiana, USA

Wave propagation in random fiberous networks

Babaee, Sahab, sbabaee@fas.harvard.edu; Wang, Pai; Bertoldi, Katia, Harvard, United States; Shahsavari, Shervin, Rensselaer Polytechnic Institute, United States; Picu, R. C., Rensselaer Polytechnic Institute, United States

ABSTRACT

Random fiberous networks are ubiquitous in different length scales with a broad range of applications including biological tissues, paper, polymer transistors, protective clothing and packaging materials. Given the importance of fiber networks, their static behavior has been extensively studied and it has been shown that network deformation is nonaffine for compliant, low-density networks and affine for stiff, high-density networks. However, little is known about the dynamic response of fibrous systems. In this study, we investigated numerically the propagation of small-amplitude elastic waves in these random networks and characterize their dynamic response as a function of network parameters. Interestingly, our numerical analysis revealed that the low-frequency response of these fiberous networks is highly affected not only by the network parameters, but also by the wavelength of the propagating waves.