Investigation of Variable-order Fractional Wave Propagation in Granular Materials

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Abstract: Recent decades have witnessed a fast growing research on the theory of wave propagation in granular materials because of its important applications of frequency dependent attenuation. Fractional calculus has been recognized as an efficient tool to model such kind of phenomena. This study firstly presented a survey of the frequency-dependent attenuated fractional wave models. To have a better understanding of the wave propagation in layered materials, the variable-order fractional wave equation is subsequently proposed on the basis of the corresponding viscoelastic constitutive equation. Numerical simulations compared with traditional models are presented by the implicit finite difference method to the efficiency of the proposed model. The present model is found to better describe the wave equation at low- and high- frequency with varying fractional order for layered granular materials.