Complex Moduli Measurement of Electro-Rheological Fluids and Modeling of its Smart Structures

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ABSTRACT

The purpose of this study is to investigate the dynamic characteristics of both the Electro-Rheological fluid alone and the sandwich beam with embedded ER fluid as a whole. Since the ER fluid embedded within the sandwich beam is subjected to cyclic shear strain in the vibrational environment, testing fixture with fluid filled between parallel plates is designed and used with traditional setup in vibration measurements. The complex moduli, loss factor, and dissipated energy of the ER fluid under different electric fields, strain amplitudes and shearing frequency are measured and discussed. In addition, the theoretical model proposed by Lee for both the ER fluid and the sandwich beam with embedded ER fluid are used to predict the responses under different straining amplitudes respectively. It is found that the theoretical models predict excellent results qualitatively and quantitatively.

Keywords : Electrorheology Fluid ; Smart Materials ; Sandwich Beam ; Smart Structure ; Dynamical Measurement ; Cyclic Shear Strain

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