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Inverse Analysis of Viscoelastic Material Properties Considering Time- and Temperature-Dependence of Poisson's Ratio

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Abstract: This study proposes a method for identifying viscoelastic properties that considers time- and temperature dependence of Poisson's ratio using inverse analysis. In this method, displacement distribution, which are input values of inverse analysis, is measured by digital image correlation [1], and unknown material properties are determined using the virtual fields method [2]. This method targets plane stress condition and the Poisson's ratio of the viscoelastic body depends on the time and temperature [3]. This study focuses on the correspondence law and proposes a method for calculating stresses considering time- and temperature dependence of Poisson's ratio. In-plane strains are measured and a through-thickness strain is computed by numerical solution by using the numerical Laplace transformation. The shear and bulk modulus are identified simultaneously by inverse analysis applying the proposed method. The effectiveness of the proposed method is demonstrated by applying to simulation of experiment by finite analysis. Results show that the stresses can be evaluated from in-plane strains and the material properties are identified by proposed method even if the Poisson's ratio exhibits time-and temperature-dependence.

Keywords: Viscoelasticity; Virtual Fields Method; Numerical Laplace transformation; Pseudoelasticity

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