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Constitutive Modeling of Rubber Components Under Small Vibration Superimposed on Large Static Deformation Considering Strain-Dependent Properties

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A steady-state viscoelastic constitutive equation of filled rubber considering the effects of large static pre-strain and dynamic strain amplitude is proposed. The proposed model is based on the linearization of Simo's finite viscoelastic model and is modified to consider the influence of static pre-deformation and the dynamic strain dependent properties. Static deformation influence factor is introduced to consider the influence of static pre-deformation on the relaxation function. And the relaxation function is modified by a function of frequency and dynamic strain amplitude in order to consider the influence of frequency and strain-dependent properties, which is called by Payne's effect. Various dynamic tests are executed in order to get the model parameters and verify the proposed model. The FEA results using the proposed model are compared with the test results to estimate the performance of the model.

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