**Structural condition assessment in accordance with the viscoelastic model for bridge health monitoring**

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**Abstract.** The vibration-based structural condition assessment methods have been widely applied for the problem of damage identification in the structure. These methods are based on identifying the variation in natural frequencies, mode shapes, and damping of the healthy and weakened structures to predict the damage. Most of the studies focus on linear elastic models. However, this model has many drawbacks in explaining some dynamic problems of the structure. Typically, in metal, the relationship between stress and strain is considered to be linear and assumed to be constant in the time domain. For viscoelastic materials such as concrete, under excitation by stochastic or transient force functions, the linear relationship may not be valid. In this paper, the viscoelastic model of Kelvin is used to investigate the flexural and torsional vibrations of beams. From there, the vibrational energy loss parameter is proposed to evaluate the degradation of the structure. The proposal is verified from the set of simulation and experimental data. It is shown that the similarity between the numerical simulation and the measured acceleration response of the beam can be obtained. The results have shown that the proposed condition assessment procedure can be used for structural health monitoring with confidence.

**Keywords:** Viscoelastic model, bending vibration, torsional vibration, energy loss, bridge health monitoring.