On weakly frequency-dependent hysteretic damping

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Typical hysteretic damping is defined as having a loss factor independent of the frequency of oscillation. Conversely, a Kelvin-type linear dashpot exhibits strong frequency dependence. In the limited case of forced harmonic oscillation, Bishop's modification of the same model was able to compensate for the frequency dependence, requiring a priori knowledge of the exciting frequency. We discuss an elaboration to Bishop's modified Kelvin model that is able to replicate a weakly frequency dependent hysteretic damping behaviour for a relatively wide range of excitations, including non-harmonic ones, without any a priori knowledge of their characteristics, as well as free vibrations that have previously been left unaddressed. We further briefly discuss a numerical solution to the equation of motion of the presented oscillator for a SDOF system, MDOF systems and, finally, present a Finite Element model for one- and three-dimensional continua.