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Nonlinear damping identification using continuous wavelet transform

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Abstract

The aim of this paper is to develop a procedure to identify nonlinear damping in oscillatory systems by means of continuous wavelet transform. The procedure is based on studying the trend of the wavelet modulus for each dominant scale with respect to time. The trend changes from an exponential decay, in the case of linear damping, to non-exponential functions of time for nonlinear damping. An equivalent viscous damping is proposed as a function of the oscillation's amplitude and the type of nonlinearity. The equivalent viscous damping versus time is calculated from the valid range of the wavelet modulus for each dominant scale. Subsequently, the effective damping is identified by processing the equivalent viscous damping and expressed in terms of recognized functions. From the free decay response, the procedure has been successfully applied to identify nonlinear systems, combined nonlinear damping and the Van der Pol equation.

Keywords: *Nonlinear system identification, Continuous wavelet transform, Modified Morlet, Equivalent viscous damping.*