Describing Functions For Effective Stiffness and Effective Damping of Hystersis Structures

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ABSTRACT

For a hysteresis structure with energy dissipation devices, the force-displacement relation is nonlinear such that it is very difficult to evaluate the actual damping and stiffness coefficients, even if the force-displacement characteristic is simply perfect elasto-plastic. With the describing function method, we can linearize the nonlinear behavior of the energy dissipation devices and then obtain the equivalent damping and stiffness coefficients; In turn, the effective period and equivalent damping ratio can be attained. It is stressed that with this approach, the imaginary part of the describing function is just the energy dissipation term, which corresponds to the conventional hystersis damping derived by the energy method. Simulation results confirm the effectiveness of this proposed method.

KEYWORDS

Describing function; hysteresis structures; energy dissipation devices; equivalent period ratio; equivalent; damping ratio.