Adaptive tuning of elasto-plastic damper

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Hysteretic dampers are frequency independent, and thereby potentially effective for several structural vibration modes, provided that the inherent amplitude dependence can be controlled. An adaptive tuning procedure is proposed, aiming at elimination of the amplitude dependence by adjusting the damper parameter(s) with respect to the magnitude of the damper motion. The procedure is demonstrated in terms of the bilinear elasto-plastic damper model, and optimality corresponds to maximum modal damping. A parametric solution for the damping ratio is obtained by a two-component system reduction technique, and maximization leads to an amplitude dependent expression for the optimal yield level. The amplitude is predicted from the most recent extremum of the damper response, and simultaneously used to adjust the yield level. Numerical examples demonstrate that the adaptive tuning procedure succeeds in controlling the amplitude dependence, resulting in equal damping for the first vibration modes.

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