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Estimation and Correction of the Modal Damping Error Involving Linear and Nonlinear Localized dissipation

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Abstract

The evaluation of damping in the assembled structures presents a real challenge. Indeed, because of the nonlinear behavior of the dissipation and their localization in interfaces, the equations of motion of a dynamic system involve coupling terms. These coupling terms are generally neglected, in engineering applications, by the community because of their complexity. Hence, a proportional damping is usually assumed even if it may provide inaccurate results. The aim of this paper is to investigate the assumptions related to modal damping in the cases of localized linear and nonlinear dissipation. To achieve this goal, a perturbation method based on an asymptotic expansion of the frequency response function is proposed. Two indices of nonlinear coupling and modal coupling are proposed in order to quantify and correct *a posteriori* the error induced by modal damping assumption. Numerical examples are proposed in order to illustrate, first, the validation of the proposed method, by comparing the results with the reference solutions, and second, the usefulness of the proposed indices in quantifying and correcting errors induced by proportional damping hypothesis.

Keywords: Modal damping, Localized linear dissipation, Localized nonlinear dissipation, Modal coupling, Nonlinear coupling, Perturbation method

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