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Dissipative Interface Modeling for Vibroacoustic Problems - A New Symmetric Formulation

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ABSTRACT

This work concerns the variational formulation and the numerical computation of vibroacoustic interior problems with interface damping. The coupled system consists of an elastic structure (described by a displacement field) containing an inviscid, compressible and barotropic fluid (described by a pressure field), gravity effects being neglected. Within the context of noise reduction techniques, we propose to investigate the effect of introducing a thin layer of damping material at the fluid-structure interface. The originality of this work lies in the introduction of an additional unknown field at the fluid-structure interface, namely the normal fluid displacement field [1, 2]. With this new scalar unknown, various interface damping models can be introduced in the variational formulation. Moreover, the associated finite element matrix system can be solved in frequency and time domains. Here, a Kelvin-Voigt rheological model is used to take into account the interface damping. For a given material, the damping parameters can be found from the experimental acoustic impedance in a particular frequency range [3]. Following the procedure developed in [4], the proposed variational formulation is written in a symmetric form through the introduction of a displacement potential of the fluid. Numerical examples are presented in order to validate and analyze the new formulation.

References

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