

ADJOINT-BASED SENSITIVITY ANALYSIS IN THE MODELING AND OPTIMIZATION OF META-PLATES

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Keywords: Adjoint method, Sensitivity analysis, Meta-structures, Resonators tuning.

Abstract

The mitigation of mechanical vibrations in plates through the inclusion of resonators, forming periodic meta-plates, is widely recognized as an effective strategy. Recently, this approach has been extended to non-periodic configurations, which may enhance desirable system characteristics through appropriate parameter tuning, thereby motivating the use of optimization tools during the modeling stage. When gradient-based optimization methods are employed, sensitivity analysis becomes a key component of the procedure and may represent a significant computational challenge. To address these aspects, the present work investigates the application of the adjoint method, which linearizes the governing equations of the model to efficiently compute the required sensitivities. The proposed approach is evaluated through a generic optimization problem involving a non-periodic meta-plate, where the objective function is the minimization of the plate displacement amplitude, subject to a constraint on the maximum mass of the resonators, and considering the resonator mass and stiffness as design variables. The results are validated through comparison with sensitivities obtained using the finite difference method, demonstrating the suitability of the proposed procedure and indicating advantages over the finite difference approach.