

Adjoint Methods of Sensitivity Analysis for Lyapunov Equation

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Abstract

The existing direct sensitivity analysis of optimal structural vibration control based on Lyapunov's second method is computationally expensive when applied to finite element models with a large number of degree-of-freedom and design variables. A new adjoint sensitivity analysis method is proposed in this paper. Using the new method the sensitivity of the performance index, a time integral of a quadratic function of state variables, with respect to all design variables is calculated by solving two Lyapunov matrix equations. Two numerical examples demonstrate the accuracy and efficiency of the proposed method. Finally, we use the adjoint sensitivity analysis scheme to solve a topology optimization problem.

Keywords: adjoint method; sensitivity analysis; topology optimization.