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Optimization of semi-active damping and external damping in mechanical systems with external force

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We present an efficient approach for determination on an optimal semi-active damping and we also consider damping optimization in systems excited by external force.

First we study the problem of determining an optimal semi-active damping of vibrating systems. For this damping optimization we use a minimization criterion based on the impulse response energy of the system. In this case the optimization approach yields a large number of Lyapunov equations which have to be solved, thus we propose an optimization approach that works with reduced systems which accelerate optimization process. Reduced systems are generated using the parametric dominant pole algorithm. The optimization process is additionally accelerated with a modal approach while the initial parameters for the parametric dominant pole algorithm are chosen during optimization procedure using residual bounds. Our approach calculates a satisfactory approximation of the impulse response energy while providing a significant acceleration of the optimization process.
In the second part we consider optimization of external damping in mechanical system excited by external force. We introduce two criteria based on the minimization of the energy functions, that allow a damping optimization in mechanical systems with external force. This optimization problem is a very demanding due to the numerous linear systems that have to be solved. For that purpose we have derived the new formulas which allow us to calculate energy functions very efficiently.

Numerical results illustrate the effectiveness of the proposed approaches.

Joint work with Peter Benner, Patrick Kürschner [1], Krešimir Veselić [2]and Ninoslav Truhar [3].

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