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Structural Optimization for Improving Local Dynamic Stiffness of Automotive Body Structure

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Abstract

The excitation loads in the low frequency range from the engine and the road affect the noise and vibration of automotive body structure directly, and the local dynamic stiffness around excitation loads is critical to reduce the noise and vibration. This paper presents the structural optimization for improving the local dynamic stiffness of body structure that applies topology and topometry optimization method. The optimization problem that minimizes the sum of modal displacements at the specific frequency with the target performance constraints over the low frequency range is formulated with the load cases of motor compartments. Topology optimization is performed to determine the body structures which significantly influence to the dynamic stiffness. The design domain is constructed by attaching solid elements to the finite element model of body structure. Topometry optimization is applied on the body structures from the topology optimization result to find the optimum positions of the reinforcement structures. It is verified that the local dynamic stiffness of the optimum design is improved while satisfying the target performance over the low frequency range.