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Structural topology optimization with eigenvalue and stress constraints using ANSYS

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Abstract

This study presents the structural topology optimization considering eigenvalue and stress constraints using Ansys. Eigenvalue is important design criteria to prevent the unwanted vibration problem of the structures. Thus, topology optimization is widely used for conceptual design of vibrating structures [1]. In addition, stress is also important because it related to failure of the structures [2]. However, most of previous studies consider them separately in topology optimization. Therefore, we present topology optimization considering both eigenvalue and stress constraints.

In this study, topology optimization was conducted using shell structures composed of shell63 element in Ansys. The design sensitivities of both constraints are evaluated by adjoint variable method. In order to conduct adjoint sensitivity analysis, the strain-displacement matrix was evaluated analytically using the internal information of ANSYS [3-5] and used for evaluation of sensitivities of stress constraint.

Numerical examples were presented to validate the proposed topology optimization. The result confirms that the proposed design method can effectively design the structures considering the both constraints. The proposed topology optimization can be used for the design of mechanical component under the consideration of the both constraints such as the suction value of the compressor.

References

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