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Topology optimization of compliant mechanism and its support through a level set method

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Abstract

In the present paper, the task of designing a compliant mechanism is accomplished by solving a multi-objective topology optimization problem. The objective function includes a target displacement at the output port and compliances of two load cases. The design variables include two types of boundaries, i.e., the traction free boundary and the Dirichlet boundary. The topology optimization of compliant mechanism and its support is solved by using a level set method. Two level set functions are used to represent a compliant mechanism and the two types of boundaries. Each of the two boundaries is represented by a part of the zero level set of one level set function. Evolution of the two boundaries is modeled by two independent Hamilton-Jacobi equations, thus the shape and topology of the two boundaries change independently. The shape derivatives are derived by using a Lagrangian function and the adjoint method. The finite element analysis is done by modifying a fixed background mesh, and the artificial weak material is not used. Numerical examples in two dimensions are investigated.

Keywords: topology optimization, compliant mechanism, support, level set method

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