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Topology optimization for heat conducting device considering stress constraints

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Heat conductivity is one of the most important characteristic of the devices guiding heat flow such as heat sink. Moreover, strength is also fundamental characteristic since heat conductive materials are sometimes used in devices requiring mechanical strength such as automotive engines. Both characteristics can be simultaneously achieved by constructing structure appropriately.

In this research, we study such structure composed of heat conductive material using topology optimization. The systematic procedure helps to find optimal structure with fine heat conductivity and enough strength. Strength requirement is implemented as stress constraints in the optimization. The proposed geometrical optimization is implemented as a distribution optimization of the dielectric material using the SIMP method of topology optimization. The optimization algorithm is constructed based on the FEM analysis, sensitivity analysis for objective functions and constraint and a phase field method. Finally, numerical examples are provided as a validation of the proposed methodology.

Keywords: Topology optimization, Heat conductivity, Stress constraint