The Hong Kong University of Science and Technology

Department of Mathematics

PhD THESIS EXAMINATION

Numerical methods for topology optimization and applications

By

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ABSTRACT

Topology optimization is an important design tool for high performance components and devices. In this thesis, we explored numerical methods for topology optimization and applications.

The minimum compliance problem is one of the simplest and most important problems in structural optimization. We reviewed the energy principles in linearized elasticity theory and reformulated the minimum compliance problem into a minimum-minimum problem, which is suitable for the threshold dynamics method to be used. We proved energy decaying property and verified it numerically. Two effective continuation methods have been proposed to get a better local minimum. The same thresholding algorithm has also been applied to the heat transfer problem.

Phase field method models the moving of interface between two phases. The gradient flow of the compliance could be computed by sensitivity analysis. We thus applied the phase field method to the minimum compliance problem. To increase the time step, a convex splitting scheme to the Cahn-Hilliard equation and truncation to the phase field function have been used.

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