

Flow Rate Constrained Topology Optimization of the Manifold with Level Set-Based Boundary Representation

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In this paper, the topology optimization based on the level set method is applied to manifold, in order to design the energy efficient optimal flow channel layout. In the optimization process, steady state incompressible viscous flow is assumed. Furthermore, the constraint functional such that the flow rate ratio of each outlet boundary to the inlet flow rate is considered in addition to the volume constraint functional. And the objective function is set as the viscous dissipation rate, which means that the flow loses its energy by viscous resistance, and the potential energy reduces for it. The optimal configuration of the manifold will be provided in both 2D and 3D numerical examples. As the result of it, the optimal flow channels which satisfy the requirement implemented as the flow rate constraint will be also presented successfully.

Keywords: Topology optimization, Level set method, Flow rate constraint, Incompressible viscous flow, Manifold