EngOpt2018 - 6th International Conference on Engineering Optimization
Instituto Superior Técnico, Lisbon Portugal • 17-19 September, 2018
Editors: H.C. Rodrigues, J. Herskovits, C.M. Mota Soares, et al.

Abstract ID 1182

FLUID DIODES DESIGN IN PULSATING HEAT PIPES USING TOPOLOGY OPTIMIZATION

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Keywords: Fluid Diodes,Topology Optimization,Pulsating Heat Pipes

Abstract: The major issue of different modern machines are heat dissipation and the implementation of pulsating heat pipes (PHP) are one of the great promising solutions. Besides that, fluid diodes, which are devices that allow the fluid flow preferentially in one direction without moving parts, have been recently applied in PHP in the literature as good solution on improving thermal resistance and internal fluid flow. Therefore, this work explores how the PHP design can be improved using topology optimization focusing on the fluid diodes, avoiding project time consumption and creating new non-intuitive geometries properly to the PHP. The implementation of the optimization uses interior point optimizer and it is based on python language with FEniCS-Framework helping calculate the objective function and Dolfin-Adjoint Framework estimating the respective gradients. The objective function is the maximization of the heat exchange based on the fluid flow. The fluid material model used is based on the Borrvall and Petterson (2012) approach which makes possible the continuity between solid and fluid. The optimization problem is solved by using an interior point optimization algorithm (IPOPT). Helmholtz equations are used to filter some results in order to control the minimum dimensions of topology. 2D geometries are presented as a result showing the improvements related to the traditional devices.