Abstract ID 1117

THICKNESS CONSTRAINTS FOR TOPOLOGY OPTIMIZATION USING THE FICTITIOUS PHYSICAL MODEL

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Keywords: fictitious physical model,geometrical constraint,thickness,dispersive coefficient,high order homogenization,topology optimization

Abstract: Thickness constraint is an important geometrical constraint in topology optimization methods. We present a novel approach of the thickness constraint based on the Fictitious Physical Model (FPM). The FPM is formulated using the similarity of the dispersive coefficient in high order homogenization [1]. The thickness constraint is represented using the solutions of the liner partial deferential equation system. Its design sensitivity is derived using the adjoint variable method. Several numerical examples are shown to confirm the validity and utility of the proposed method using the level set-based topology optimization method [2]. The main advantage of the proposed method is the allowance of thickness constraint violations during the optimization procedure. Furthermore, the thickness is computed without computing minimum distances from the boundaries of target shape. [1] G. Allaire, T. Yamada, Optimization of dispersive coefficients in the homogenization of the wave equation in periodic structures, hal-01341082. [2] T. Yamada, K. Izui, S. Nishiwaki, A. Takezawa, A topology optimization method based on the level set method incorporating a fictitious interface energy, Computer Methods in Applied Mechanics and Engineering, Vol.199, No.45-48, pp.2876-2891 (2010).