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Fluid-structure interaction in natural convection heat transfer in an oblique cavity with a flexible oscillating fin and partial heating
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Abstract
Unsteady natural convection in a differentially heated oblique cavity with a flexible oscillating heat-conducting fin mounted on the bottom adiabatic wall is studied numerically by using the finite element method. The right inclined wall is kept at a constant low temperature, while the left one is adiabatic with a local isothermal heater, the fin is heated isothermally from the basis. The heat-conducting elastic fin is located in the central part of the bottom adiabatic wall. The Galerkin weighted residual finite element method with the aid of the Arbitrary Lagrangian-Eulerian (ALE) procedure is used in the numerical analysis. The developed computational code was validated comprehensively using a grid independency test, and numerical data of other authors. The governing parameters of this study are the dimensionless time (10-8⩽t≤3.5), thermal conductivity ratio between the heat-conducting fin and working medium (1⩽Kr≤1000), non-dimensional Young's modulus (109⩽E≤1012), oscillating amplitude (0.01⩽A⩽0.1), left wall heater length (0.1⩽H≤0.9), and the inclination angle of tilted walls (-45⩽ϕ⩽45). The obtained results revealed an essential effect of the flexible oscillating heat-conducting fin on the fluid flow and heat transfer inside the oblique cavity. © 2018 Elsevier Ltd

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