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Fluid-structure interaction analysis of entropy generation and mixed convection inside a cavity with flexible right wall and heated rotating cylinder
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Abstract
The current work concentrates on the transient entropy generation and mixed convection due to a rotating hot inner cylinder within a square cavity having a flexible side wall by using the finite element method and arbitrary Lagrangian-Eulerian formulation. Effects of various relevant parameters like Rayleigh number ($10^4 \leqslant Ra \leqslant 10^7$), angular rotational velocity ($-1 \leqslant \Omega \leqslant 1$), dimensionless elasticity modulus ($10^{12} \leqslant E \leqslant 10^{15}$) on the convective heat transfer characteristics and entropy generation rates are analyzed for dimensionless time $10^{-8} \leqslant \tau \leqslant 3.5$. It is observed that various complex shaped wall deformations are established depending on the non-dimensional elastic modulus of the flexible right wall and cylinder rotation direction. The local and average Nusselt numbers rise with Ra and secondary peaks in the local Nusselt number are established for lower values of Ra. The local heat transfer along the hot cylinder does not change for the case of clockwise rotation of the heated cylinder even if there is a wall deformation in the positive x-direction. The highest average heat transfer and global entropy generation rates are achieved for the case of counter-clockwise rotation of the circular cylinder and for lower values of the flexible wall deformation. © 2019 Elsevier Ltd

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