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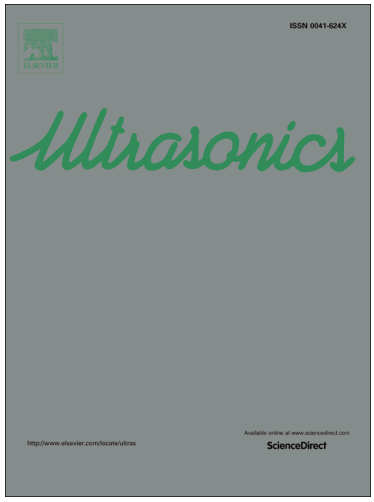

Numerical investigation of natural convection heat transfer in a cylindrical enclosure due to ultrasonic vibrations

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Numerical investigation of natural convection heat transfer in a cylindrical enclosure due to ultrasonic vibrations

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Abstract

Application of ultrasonic waves for heat transfer augmentation has been proposed in the last few decades. Due to limited researches on acoustic streaming induced by ultrasonic oscillation, the effect of ultrasonic waves on natural convection heat transfer is the main purpose of this paper. At first, natural convection on up-ward-facing heating surface in a cylindrical enclosure filled with air is investigated numerically by the finite difference method, Then the effect of upper surface oscillation on convection heat transfer is considered. The conservation equations in Lagrangian approach and compressible fluid are assumed for the numerical simulation. Results show that acoustic pressure will become steady after some milliseconds also pressure oscillation amplitude and acoustic velocity components will be constant therefore steady state velocity is used for solving energy equation. Results show that Enhancement of heat transfer coefficient can be up to 175% by induced ultrasonic waves. In addition, the effect of different parameters on acoustic streaming and heat transfer has been studied.

Key word: Ultrasonic waves, Heat transfer augmentation, Acoustic streaming, Lagrangian approach, Compressible fluid

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