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Control of hybrid nanofluid natural convection with entropy generation: A LBM analysis based on the irreversibility of thermodynamic laws

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Abstract

This article analyzes the irreversibility of the natural convection of water/copper nanofluids in a square enclosure. Thermal entropy generation, frictional entropy generation, and total entropy generation are examined by changing the Hartmann number, thickness and length of baffles, and magnetic field with inclinations angle. Three baffles are mounted on the hot wall of the enclosure. The wall in front of the hot wall is cold and the other walls are insulated. The numerical method is employed for this analysis using the Lattice Boltzmann method. The results of this study demonstrate that an increment in the Ha reduces the horizontal and vertical velocity components of the water/copper nanofluids in the enclosure and reduces the temperature gradient. Also, an enhancement in the Ha reduces all types of ETG. An increment in the angle of the magnetic field enhances thermal entropy generation, frictional entropy generation, and total entropy generation. Enhancing the magnetic field, first decreases and then increases the Bejan number.