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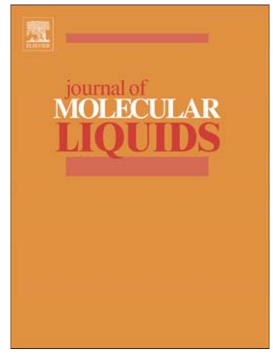

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Nikita S. Gibanov, Mikhail A. Sheremet, Ioan Pop

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Natural convection of micropolar fluid in a wavy differentially heated cavity

Nikita S. Gibanov[1], Mikhail A. Sheremet[1,2], Ioan Pop[3]

[1]Department of Theoretical Mechanics, Tomsk State University, 634050, Tomsk, Russia

[2]Department of Nuclear and Thermal Power Plants, Tomsk Polytechnic University, 634050, Tomsk, Russia

[3]Department of Applied Mathematics, Babeş-Bolyai University, 400084 Cluj-Napoca, Romania

ABSTRACT

An analysis of natural convective flow and heat transfer of a micropolar fluid in a wavy differentially heated cavity has been performed. Governing partial differential equations formulated in non-dimensional variables have been solved by finite difference method of second order accuracy. The effects of Rayleigh number ($Ra = 10^4, 10^5, 10^6$), Prandtl number ($Pr = 0.1$, 0.7, 7.0), vortex viscosity parameter ($K = 0$, 0.1, 0.5, 2.0) and undulation number ($\kappa = 1, 2, 3$) on flow patterns, temperature fields and average Nusselt number at hot wavy wall have been studied. It is found that microrotation increases as the vortex viscosity parameter K increases. However, the fluid velocity decreases as K increases. It is observed that the form of streamlines is dependent on the value of vortex viscosity parameter. An increase in the undulation number leads to a decrease in the heat transfer rate at wavy wall.

Keywords: Wavy cavity, Natural convection, Micropolar fluid, Numerical results

1. Introduction

Over the relatively many years, fluid flow of micropolar fluids has received considerable attention because of its important applications in engineering. The interest in micropolar fluids, which exhibit the microrotational effects and microrotational inertia, started very soon after the pioneering studies by Eringen [1, 2]. These fluids cannot be explained on the basis of Newtonian fluid flow theory. Since the publication of this micropolar fluid theory, many authors have investigated various flow and heat transfer problems. According of this theory, the deformation of the fluid microelements is ignored: nevertheless microrotational effects are still present and