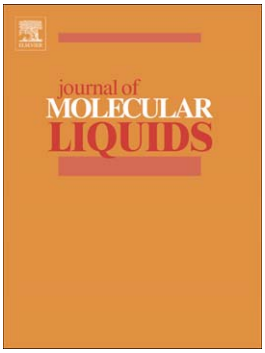

Entropy generation minimization (EGM) in nonlinear mixed convective flow of nanomaterial with Joule heating and slip condition

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Entropy generation minimization (EGM) in nonlinear mixed convective flow of nanomaterial with Joule heating and slip condition

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Abstract: Main emphasis here is to investigate the novel characteristics of entropy generation in nonlinear mixed convective flow of nanofluid between two stretchable rotating disks. Buongiorno nanofluid model of nanomaterial is implemented in mathematical modeling. Nanofluid aspects for thermophoresis and Brownian movement are considered. Heat transport mechanism is examined subject to convective condition and Joule heating. Velocity slip is considered at the lower and upper disks. Total entropy generation rate is discussed. Systems of PDEs is first converted into ODEs and then tackled by for convergent solutions. The impacts of Reynold number, Prandtl number, Hartman number, velocity slip parameter, Biot numbers of heat and mass transfer, thermophoresis, Brownian motion, nonlinear convection parameters for temperature and concentration, mixed convection parameter and Schmidt number on velocities, temperature, Bejan number, concentration and total entropy generation rate are graphically examined. Our investigation reveal that entropy generation rate and Bejan number have inverse behavior for higher estimation of Hartman number. Moreover velocity and temperature gradients are physically interpreted.

Keywords: Two rotating disks; Entropy generation and Bejan number; Convective boundary conditions; Velocity slip; Joule heating; nanofluid (Buongiorno model).

1 Introduction

Liquids with low thermal conductivity are principal impediment to escalate the heat transport in engineering frameworks. Thus it is essential to have liquids of high thermal conductivity. Nanoliquids are considered important for this purpose. The thermal conductivity of nano-

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