Paper ID: 84689
oral
student

IAF MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM (A2)
Fluid and Materials Sciences (2)

Author: Ms. Niba Kainat
Università degli Studi di Palermo, Italy

Dr. Vincenzo Gulizzi
Università degli Studi di Palermo, Italy

FLOW WITH TEMPERATURE DEPENDENT VISCOSITY AND THERMAL CONDUCTIVITY OVER RADIATIVE NEEDLES

Abstract

The flow field generated by a radiative needle moving in a fluid with temperature dependent viscosity and thermal conductivity is analyzed in this work. Both the cases of linear and nonlinear radiation are considered to understand their impact on flow behavior. The governing equations are written in cylindrical coordinates under axial symmetry constraint. Upon introducing a similarity variable transformation, it is shown that the equations can be converted into a set of nonlinear first-order differential equations, which are then solved numerically. Numerical results are presented in terms of parametric analyses considering different values of a velocity ratio parameter and the Nusselt number, and their effect on the friction coefficient and heat transfer. The impact of no viscous dissipation is also discussed. From the computational perspective, the effect of the number of mesh points on the maximum error is reported. Eventually, it is shown that the present method allows recovering existing literature results as special limiting cases.

Keywords: radiative needles, nonlinear radiation, temperature-dependent viscosity, temperature-dependent thermal conductivity