Entropy generation analysis in radiative and dissipative Casson hybrid ferrofluid past a thin needle

MD. Shamshuddin[1a] and S.O. Salawu[1b]

[a] ADeprtment of Computer Science and Artifical Intelligence (Mathematics), SR University, Warangal-506371, Telangana, India
[b] ADepartment of Mathematics, Bowen University, Iwo, Nigeria

ABSTRACT

The desire to improve thermal conductivity and optimize industrial-based materials for greater efficiency and productivity has fueled numerous investigations on nanomaterials and non-Newtonian fluids. The uses of nanotechnology in technological advancement and industrial promotion could not be overstressed.Thus, the aim of this study is to numerically investigate the entropy formation, heat propagation and conduction of hybridized Casson ferrofluid with dissipation and radiation in a thin needle. The inherent heat transfer capability of magneto-hybridized Fe_2O_3 and Al_2O_3 solid nanoparticles in H_2O based solvent motivated the study. The streaming nanofluid is controlled by magnetic field, heat generation and continuous stretching velocity. A partial derivative mathematical model is developed to describe the flow dimensions, and via suitable similarity variables have used to change the system of leading equations into dimension-free form. A numerical and localized spectral linearization scheme is adopted for the thermodynamic and parameters sensitivities analyzes of the thermal fluid. As observed, the heat transfer comparison rate establishes that the thermal propagation of Fe_2O_3-Al_2O_3/water is 8.28% higher than Al_2O_3/water at 0.01% of volume fraction. The entropy formation is raised with rising nanoparticle size, and radiation and dissipation terms boosted temperature distribution.

Keywords: Hybrid ferrofluid; Hydromagnetc; Entropy formation; Viscous dissipation