CHRIST

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BANGALORE · INDIA

BOOK OF ABSTRACTS

INTERNATIONAL CONFERENCE ON

EMERGING TRENDS IN COMPUTATIONAL FLUID DYNAMICS

(ICETCFD-2019)

27-28, February 2019

Department of Mathematics
CHRIST (Deemed to be University)
Bangalore-560029, Karnataka, INDIA.

NUMERICAL COMPUTATION ON MARANGONI CONVECTIVE FLOW OF TWO-PHASE MHD DUSTY NANOFLUIDS UNDER BROWNIAN MOTION AND THERMOPHORESIS EFFECTS

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Abstract: Present theoretical study describes the Marangoni thermal convective flow of magnetohydrodynamic dusty nanofluids along a wavy vertical surface. The two-phase mathematical model is developed under the influence of thermal radiation and exponentially varying space-dependent heat source. Pure and hybrid nanoparticles together with dust particles suspension in the base fluid are taken into consideration to characterize the behavior of the flow. Brownian motion and thermophoresis mechanisms are considered, since it enhances the convection features of dusty nanofluid. Appropriate transformations are adopted to modify the flow governing equations and boundary conditions to dimensionless form. The forward finite difference scheme is implemented to illustrate the resultant coupled partial differential equations. Newton's quasilinearization technique is utilized to reduce the nonlinear system into linear form which is solved thereafter by Thomas algorithm. The responses of velocity, temperature, concentration, friction factor, heat and mass transfer rate profiles with various governing parameters are discussed and portrayed graphically. The study evidences that the radiation and space-dependent heat generating parameters strengthen the temperature distribution. Also, the heat transfer rate appreciably rises with the increment in Marangoni convection. The solution methodology and accuracy of the model is validated by generating the earlier outcomes for non-radiating nanofluid flow without heat source/sink.

Keywords: Dusty nanofluids, Marangoni convection, space-dependent heat source, two-phase flow, wavy surface

Mathematics Subject Classification 2010: 76T10, 76T15.

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