Research Article

Analytical study for MHD flow of Williamson nanofluid with the effects of variable thickness, nonlinear thermal radiation and improved Fourier's and Fick's Laws

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Abstract
The key aim of the present work is to analyze the magnetohydrodynamic 2D flow of Williamson type nanofluid. Heat and mass transfer impacts are carried out in the manifestation of nonlinear thermal radiation, Cattaneo–Christov heat and mass flux models and varying thicker surface. By applying the appropriate similarity transformations, the mathematical equations of velocity, temperature and volume fraction transform to NODEs. An analytical scheme is pragmatic to estimate the convergence solutions in terms of power series. The dimensionless velocity profile, temperature profile and nanoparticle volume fraction with the administrative physical aspects are depicted through graphs. It is evidently ostensible that the dimensionless velocity declines for the augmented index parameter and wall thickness while cumulative values of M and β, the horizontal fluid velocity decreases. Temperature specie upsurges with rising of Nb, Nt, n, β, R_d, θ_w and M. Consequently demotes with the higher values of Pr and De_1. Nanoparticle volumetric specie escalates with the growing effects of Nt, while it diminishes with Nb, Sc and De_2. Comparison is the key procedure for validation our results with the earlier literature.

Keywords Williamson nanofluid · Nonlinear thermal radiation · Variable thickness · HAM · Cattaneo–Christov heat/mass fluxes

1 Introduction

Nanofluids is the name discovered by Choi [1] to interpret this novel class of nanoparticles based fluids that demonstrates thermal inheritances higher-up to those of their base fluids. Due to their small size usually less than 100 nm, nanoparticles fluidize simply in the base fluid and as a result, clogging and erosion in channels are no longer a problem. These particles carry only a few thousand atoms and own properties that are substantially differ from their original materials. Recently there have been several advancements which have made the nanofluids more stable and ready for use. Nanofluids find potential applications in electronic devices as they have higher denser chips with compact design which makes heat dissipation difficult, heat pipes in the computer devices to improve heat dissipation, industrial cooling uses resulting in excellent energy savings and emission reduction, for cooling nuclear systems, space and defense because of the restriction of space and heat exchangers to improve heat transfer rates, in fuel cell, Solar water heaters, chillers, domestic refrigerator and as lubricants in machining.

Nanofluids are not merely liquid–solid amalgams but are composed by dispersing nanometer-scale solid particles into

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"COVID -19 & I"

A study of the Social and Mental wellbeing of oneself on the PERMA profiler

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Abstract-

The paper studies the mental and social wellbeing of society in general on the basis of the PERMA profiler given by Martin Seligman. The profiler studies the 5 pathways along with the 3 additional profile of a human psychology during the COVID -19. The results show that respondents are still able to maintain their mental and physical well being during the pandemic that provides a signal of relief for the society.

Key words- COVID-19, well being of Society, PERMA Profiler.

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