FLUID PARTICLE INTERACTION OF CASSON-WILLIAMSON FLUID WITH MAGNETOHYDRODYNAMICS (MHD) AND THERMAL RADIATION

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ABSTRACT

Casson and Williamson fluids are commonly used non-Newtonian models in everyday scenarios, but when dealing with complex problems, they must be combined. Non-Newtonian fluids with solid particles are called dusty non-Newtonian fluids. The combination of dust with two non-Newtonian models has garnered considerable attention due to its relevance in modern industries. Therefore, the main purpose of this research is to explore the behaviour of Fluid Particle Interaction of Casson-Williamson fluid under MHD and thermal radiation circumstances. The Partial Differential Equations (PDEs) are converted into Ordinary Differential Equations (ODEs) using similarity variables, and then solved using the Keller-Box method in MATLAB. This study utilizes tables and graphs to examine the effects of various parameters like Casson, Williamson, magnetic field, Prandtl number, radiation, and fluid-particle interaction across velocity and temperature profiles. A good conformity of the current results has been achieved after comparing with previous literature studies. The current results align with both analytical and numerical data, hence, validating the developed numerical algorithm and graphical outputs. The results indicate that as the Williamson and Casson parameters increase, the velocity of both the fluid and dust phases decreases, while the temperature profile for both phases rises. Additionally, the fluid-particle interaction parameter affects each phase differently: as this parameter increases, the velocity and temperature of the fluid phase are decreased, whereas both dust phases are increased.

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