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UNSTEADY SECOND GRADE ALIGNED MHD FLUID THROUGH POROUS MEDIA IN A ROTATING FRAME: A CLASS OF EXACT SOLUTIONS USING INVERSE METHOD

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Abstract: This study presents exact analytical solutions for the unsteady plane flow of an electrically conducting second-grade fluid within a rotating frame, permeating a porous medium under the action of a magnetic field. The analysis employs the inverse method, wherein suitable *a priori* assumptions for the vorticity and stream function yield consistent forms of the velocity field and pressure distribution. Closed-form expressions for the governing flow variables are derived, ensuring compliance with both the fundamental equations and physical constraints. The influence of critical parameters, such as rotational effects, magnetic field intensity, porous medium resistance, and non-Newtonian fluid characteristics, is examined in detail. Graphical illustrations highlight the role of these parameters in shaping the flow dynamics, offering deeper insight into the complex interplay between rotation, magnetohydrodynamic forces, and porous medium interactions.

Keywords and Phrases: MHD, porous medium, inverse method, exact solution, stream function, unsteady flow.

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