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Application of Caputo Fractional Derivatives to the Convective Flow of Casson Fluids in a Microchannel with Thermal Radiation

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Abstract:
In this paper, the application of Caputo fractional derivative on unsteady boundary layer Casson fluid flow in a microchannel is studied. The partial differential equations which governed the problem are considered with the presence of thermal radiation. The fractional partial differential equations are transformed into dimensionless governing equations using appropriate dimensionless variables. It is then solved analytically using the Laplace transform technique which transforms the equations into linear ordinary differential equations. These transformed equations are then solved using the appropriate method, and the inverse Laplace transform technique is applied to obtain the solution in form of velocity and temperature profiles. Graphical illustrations are acquired using Mathcad software and the influence of important physical parameters on velocity and temperature profiles are analyzed. Results show that thermal radiation and fractional parameter have enhanced the velocity and temperature profiles.