UNSTEADY GRAVITY-DRIVEN RIVULET FLOW OF NON-NEWTONIAN POWER-LAW FLUIDS WITH STRONG SURFACE-TENSION EFFECT

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ABSTRACT

The study investigates the unsteady flow behaviour of rivulets formed by non-Newtonian power-law fluids under the influence of gravity wuth strong surface-tension effects. These rivulets exhibit distinct behaviours in response to different power-law exponents N that determine the shear-thinning or -thickening qualities. Their dynamics are characterised by the power-law fluid behaviour. The stream flow, on slanted surfaces and accelerated by gravity, is examined with the important impact of surface tension in mind.

Because the rivulet is thin and slender, the research focuses on governing lubrication equations that describe continuity and motion in several directions. By solving these equations and maintaining boundary conditions at the substrate and free surface, the result of pressure, velocities, and local fluxes can be obtained. Using these discoveries, a thorough analysis yields governing partial differential equations that dictate the dynamics and changing shape of the rivulet over time. Additionally, comparisons are drawn between the value of H_0 at different value of N and H_2. We will also validate the result with previous study from Redwan and Yatim (2019). In this study, we will use Runge-Kutta Fehlberg 4 and 5 order to solve the ordinary differential equation numerically. For this method we will use Maple 2016 to produce the result.

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