

# Runup Flow of Couple Stress Fluid Through Parallel Plates Due to Sudden Stoppage of Pressure Gradient

*D. Anjali, J.V. Ramana Murthy\* and Naresh Reddimalla*

Department of Mathematics, National Institute of Technology Warangal – 506004,

Telangana State, India

\*Corresponding author email: [jvr@nitw.ac.in](mailto:jvr@nitw.ac.in)

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**Abstract:** The investigation of the behaviour of Couple stress fluid flow between two parallel plates under sudden stoppage of the pressure gradient is considered. Initially flow of couple stress fluid is developed between the two parallel plates under constant pressure gradient. Suddenly, the applied pressure gradient is stopped and the resulting unsteady flow is studied. This type of flows is known as runup flows in literature. Now the flow is expected to come to rest in a long time. Usually, these types of problems are solved by using Laplace Transform technique. There are difficulties in obtaining invert the transform and hence numerical inversion of Laplace Transforms is adopted. In this paper, the problem is solved by using separation of variable method. This method is easier than Transform method. The velocity field is analytically obtained by applying usual no-slip condition and hyper-stick conditions on the plates and hence volumetric flow rate in subsequent times is derived. Initial steady state solution is matched with the initial condition on time. The graphs for velocity field at different time and at different couple stress parameters are drawn. The special case when couple stress parameter approaches infinity, couple stress fluid becomes a viscous fluid. Our results are in good agreement with this special case.

**Keywords:** Run up flow, Couple stress fluid, Separation of variable method, Pressure gradient