

UNSTEADY FLOW OF COUPLE STRESS FLUID IN CONTACT WITH A NEWTONIAN FLUID BETWEEN PERMEABLE BEDS

S. SREENADH¹, A. PARANDHAMA² AND R. HEMADRI REDDY³

¹Department of Mathematics,
Sri Venkateswara University, Tirupati- 517502, India

²Department of Mathematics,
Vaishnavi Institute of Technology, Tirupati, India

³School of Advanced Sciences,
VIT University, Vellore-632014, India

Abstract

Unsteady flow of two immiscible fluids between two permeable beds of different permeability is analyzed. The flow region between permeable beds is divided into two regions. The flow region between the nominal surface of the lower permeable bed and the interface $y = 0$ is named as Region-1 and the flow region between the interface and the upper permeable bed is designated as Region-2. The flow in Region-1 is described by Couple stress model and the flow in Region-2 is governed by Navier-Stokes equations. The flow is assumed to be driven by an exponentially time dependent pressure gradient. Expressions for the velocity distributions in the two regions, interface velocity and the mass flow rate are obtained. The effects of physical parameters such as couple stress parameter and viscosity ratio on the flow are found and shown graphically.

Key Words : *Couple stress fluid, Newtonian fluid, Permeable bed.*