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STABILITY OF SUPERPOSED VISCOELASTIC FLUIDS IN THE PRESENCE OF SUSPENDED PARTICLES THROUGH POROUS MEDIUM

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ABSTRACT

In the present paper, we study the stability of superposed viscous-viscoelastic fluid in the presence of suspended particles through porous medium in which the density of viscous liquid varies exponentially negative. The instability in the porous medium of a place interface between viscous (Newtonian) and visco-elastic fluid containing suspended particles may be of interest in Geophysics, Chemical technology and Biomechanics and is therefore studied in the present paper. The affects of a variable horizontal magnetic field and uniform rotation bearing relevancy in Geophysics are also considered.

Key Words: Hydro magnetic, visco-elastic fluid, instability of the plane, kinematic viscoelasticity, porous medium.

AMS Subject Classification (2000): 76E25, 74 L15

INTRODUCTION

The Rayleigh-Taylor instability of a Newtonian viscous fluid overlying Walters B' viscoelastic fluid containing suspended particles in a porous medium is considered or the stable configuration the system is found to be stable or unstable if $v_1 d \leq k_1/\varepsilon\alpha_1$, depending upon kinematics viscoelasticity, permeability of the medium and density of the medium. The system is found to be unstable in the potentially unstable case. The effect of a variable horizontal magnetic field and a uniform rotation are also considered. For the stable configuration, in the hydro magnetic case also, the system is found to be stable or unstable if $v_1 \leq k_1/\varepsilon\alpha_1$. However, for the unstable configuration, the magnetic field and viscoelasticity have got stabilizing effects. The system is found to be unstable for the potentially unstable case, for highly viscous fluids, in the presence of a uniform rotation. Nidhi Bansal at el. (1999) Shear flow instability of an incompressible Visco-elastic fluid in a porous medium in the presence of a weak magnetic fluid.

When two fluids of different densities are superposed one over the other or accelerated towards each other, the instability of the plane interface between the two fluids, when it occurs, is called Rayleigh-Taylor instability. Chandrashekhar (1981) has given a detailed account of the instability of the plane interface separating two electrically conducting, incompressible superposed fluids of uniform densities, when the whole system is immersed in a uniform horizontal magnetic field, has been studied by Bhatia (1974). Basant Kumar Jha (1998) has carried out the stability analysis for two fluids of high viscosities and different uniform densities. Sharma and Kumar (1998) have studied the stability of two superposed Walters B' viscoelastic fluids and the analysis has been carried out mathematically simplicity for two highly viscoelastic fluids of equal kinematics viscosities and equal kinematics viscoelasticity. It is found that for stable configuration, the system is stable or unstable under a certain condition, however, the system is found to be unstable for the unstable configuration. Recently Sharma and Kumar (1997) have studied the Tayleigh-Taylor instability of two superposed conducting Walter B' elastic viscous fluids in hydro magnetic.

In geophysical situations, the fluid is often not pure but certain suspended articles. Scanlon and Segel (1973) have considered the effects of suspended particles on the onset of Benard convection and found the critical Rayleigh number is reduced because of the heat capacity of the particles. The suspended particles were thus found to be destabilize the layer. Palaniswamy and Puroshotham (1981) have studied the stability of shear flow of stratified fluids with fine dust and found the effects of fine dust to increase the region of instability. The medium has been considered to be non-porous in all the above studies.

The flow through porous media is of considerable interest for pertroleum engineers and for geophysical fluid dynamicists. When the fluid slowly percolates through the pores of a macroscopically homogenous and isotropic porous medium, the gross effect is represented by Darcy's law according to which the usual viscous term in the equations of fluid motion is replaced by the resistance term $[-\{\frac{\mu}{k_1}\} v]$ where μ is the viscocity of the fluid k_1 is the permeability of the medium and v is the Darcian (filter) velocity of the fluid. Lapwood (1948) has studied the stability of convective flow in hydromagnetics in a porous medium using Rayleigh's procedure. The Rayleigh instability of a thermal boundary layer is flow through porous medium has been considered by Wooding (1960). The thermal instability of fluids in a porous medium in the presence of suspended particles has been studied by Sharma and Sharma (1982). The suspended particles and the permeability of the medium were found to destabilize the layer. Sharma and Kumar (1995) have studied the Rayleigh-Taylor instability of fluids in porous media

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