# Effects of viscous dissipation on convective and absolute instability in viscoelastic mixed convection flows in porous media

L. Alves[(1)], A. Barletta[(2)], S. Hirata[(3)], M. N. Ouarzazi [(3)]

(1) Laboratorio de Mecanica Teorica e Aplicada, Departamento de Engenharia Mecanica, Universidade Federal Fluminense, Rua Passo da Patria 156, Bloco E, Sala 216, Niteroi, RJ 24210-240, Brazil

(2) Department of Industrial Engineering, Università di Bologna, Viale Risorgimento 2, 1-40136 Bologna, Italy

(3) Laboratoire de Mécanique de Lille, UMR CNRS 8107, USTL, Bd. Paul Langevin, 59655 Villeneuve d'Ascq cedex, France

corresponding author : najib.ouarzazi@univ-lille1.fr

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Thermal instability in fluid saturated porous media as well as in clear fluids has been investigated extensively during the last few decades. The presence of a superposed horizontal through-flow, in addition to a vertical thermal gradient, leads to an interesting linear and nonlinear behaviour. For a porous medium, Delache et al. [1] performed a spatio-temporal stability analysis by considering both extended and localized perturbations. Quantitative comparisons between their findings and experimental results published in the literature were presented. It is found that the experimentally observed transition between down-stream moving transverse rolls (*T* rolls) and stationary longitudinal rolls (*L* rolls) occurs at the border between convective and absolute instability predicted theoretically. Recently, Nield and Barletta [2] extended the temporal stability analysis of that problem by taking into account viscous dissipation. They found that, under both the effect of a horizontal though-flow and the effect of viscous dissipation, the system selects *T* rolls at the onset of the convective instability. Moreover, they predict a destabilization of the base flow induced by viscous dissipation. The destabilization can be so important that the onset of convective *T* rolls may occur even with a vanishing Darcy-Rayleigh number.

Interest in viscoelastic flows through porous media has also grown considerably because of its wide range of applications in biorheology, as well as for design issues of interest for the chemical and petroleum industries. Convective instability thresholds for viscoelastic fluids in porous media heated from below can be found in the literature. It has been demonstrated that instability may be stationary or oscillatory, depending on viscoelastic properties of the fluid. For mixed convection problems, Hirata and Ouarzazi [3] performed a three dimensional spatio-temporal stability analysis and proved that when the base flow loses its stability, all unstable modes are convectively unstable except transverse rolls, which may experience a transition to absolute instability.

The aim of this communication is to analyse the thermal mixed convection thresholds and the linear characteristics of both convective and absolute instability for viscoelastic fluids by taking into account viscous dissipation. Thus, the present contribution may be considered as an extension of [2] to viscoelastic fluids and also an extension of [3] by including the effects of viscous dissipation. In addition to the properties of the porous medium, one has three potential sources of instability: (thermal boundary conditions, viscous dissipation and viscoelastic character of the fluid). We will use the Darcy-Oldroyd-B model as a momentum transfer equation to describe the combined effects of these three sources of instability.

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