# NATURAL CONVECTION OF POWER-LAW FLUIDS IN ENCLOSURES

**A. Sachdeva, O. Turan, N. Chakraborty, R.J. Poole**

University of Liverpool, School of Engineering, Liverpool, UK

robpoole@liv.ac.uk

Natural convection in rectangular enclosures is relevant to a wide range of engineering applications (e.g. electronic equipment cooling, energy storage and conservation) and a large body of existing literature is available. Most of this previous work is, however, concerned with Newtonian fluids. Here we study numerically laminar natural convection in rectangular enclosures (the differentially heated sidewalls case with constant temperature boundary conditions) completely filled with a non-Newtonian fluid obeying the power-law model.

Steady-state simulations have been carried out using a finite-volume method where the conservation equations were solved using a semi-implicit pressure linked algorithm. Buoyancy effects were accounted for by Boussinesq's approximation. Our Newtonian simulation results have been validated against well-known benchmark results [1] and the grid independence of the results have been established based on a careful analysis and the errors quantified using Richardson's extrapolation technique.

The effects of Rayleigh number (Ra), Prandtl number (Pr) and power-law index on heat and momentum transport are investigated for both shear thinning ($n<1$) and shear thickening fluids ($n>1$). In addition a suitable Nusselt number correlation proposed.

**References**

[1] G. de Vahl Davis, Int. J. Numer. Meth. Fluids 3 (1983) 249–264.