INVESTIGATION OF FLUID BEHAVIOR IN TWO SIDED LID DRIVEN CLOSED SQUARE POROUS CAVITY DUE TO DOUBLE DIFFUSIVE MIXED CONVECTION USING CFD TECHNIQUES

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ABSTRACT

Double diffusive mixed convection in porous media finds its application in Food processing, Geophysical systems, Grain storage, Migration of moisture through air contained in fibrous insulation, Chemicals transport in packed bed reactors and understanding the sensitivity of the flow in these applications, this paper studies the flow behavior, heat and mass transfer characteristics of the fluid inside the porous medium of the two sided lid driven cavity. The left, right walls are motion in same direction with velocity (V) while the top, bottom walls are stationary and insulated. The thermal and concentration gradients are applied along the width of the cavity right side being at higher temperature and concentration. The effect of porosity on the characteristics of the flow is analyzed by varying the Darcy number, $0.0001 \leq Da \leq 100$ keeping Richardson number (Ri) as 1.0 and also the effect of natural and forced convection is analyzed for $0.0001 \leq Ri \leq 100$ keeping the Da=0.1. The Reynolds, Lewis and Prandtl numbers are kept constant (Re=100, Le=5 & Pr=1). The governing equations are non-dimensionalised and these equations are solved using SIMPLE algorithm. Third order differed QUICK (Quadratic Upwind Interpolation for Convective Kinematics) scheme is applied at the inner nodes and second order central difference scheme is used for the boundary nodes. The code is validated with the literature and it is found to be in good agreement. The interesting numerical results predict that the flow inside the cavity is strong functions of Da and also Ri. The Nusselt number (Nu) & Sherwood number (Sh) increases and decreases along the left and the right wall for different values of Ri and Da. The average Nu and Sh increases decreases till Ri =1 and then increases.