Soret effect on unsteady free convection heat and mass transfer flow in a vertical channel with ramped wall temperature and concentration

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Abstract: This study presents analytical solutions to unsteady natural convection heat and mass transfer flow in a vertical channel in the presence of Soret effect. The bounding walls are considered to have ramped boundary conditions on the temperature and concentration. The system of the dimensionless governing coupled boundary layer PDEs have been solved analytically using the powerful Laplace Transform Technique (LTT) and numerically by constructing a program in MATLAB. Comparisons of Numerical and analytical results are made while the numerical results for the temperature, concentration, velocity as well as the heat transfer rate, mass transfer rate and wall skin friction are presented graphically. The study shows that incorporating ramped BCs makes the fluid temperature, specie concentration, flow velocity, coefficient of rate of heat transfer, coefficient of rate of mass transfer and coefficient of Skin-friction to be lower compared to the case of constant BCs. Moreover, Soret effect affects the concentration and velocity.

Keywords: Soret effect, free convection, mass transfer, ramped temperature, ramped concentration, Laplace transform technique.

2010 Mathematics Subject Classification: 76R10, 80A20, 44A10