On buoyancy induced heat and mass transfer from a concentrated point source

R Ganapathy

Department of Mathematics, National College Tiruchirapalli-620 001 India

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This paper reports an analytical study of an unsteady heat and mass transfer flow induced by an instantaneous concentrated point source in an unbounded fluid. Assuming the thermal Rayleigh number to be small, analytical solutions are obtained for the flow field, temperature and species concentration in the form of series expansions of the dependent variables in terms of the Rayleigh number. The impact of species diffusion on the buoyancy induced heat and fluid flow has been highlighted. Streamlines are drawn to demonstrate the evolution of the flow field at different times. Even though heat was specified to be one of the two diffusion mechanisms, the results apply as well to the case where the source generates simultaneously two different chemical components.

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