INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

Name of the Student	:	Ms. Chitralekha Sarkar
Roll Number	:	**09612312**
Programme of Study	:	Ph.D.

Thesis Title: **Higher order compact schemes and their applications to problems with complex geometries**

Name of Thesis Supervisor(s)	:	Professor Durga Charan Dalal
Thesis Submitted to the Department/ Center	:	Mathematics
Date of completion of Thesis Viva-Voce Exam	:	07.05.2017
Key words for description of Thesis Work	:	HOC, Complex geometries, Convection, Magnetohydrodynamics, Porous

SHORT ABSTRACT

The thesis is aimed to modify an already existing higher order compact (HOC) finite difference scheme to enhance its applicability and robustness. To examine the robustness of the proposed scheme, it is applied to lid-driven cavity problems, natural and mixed convection problems including some magnetohydrodynamic effects in some complex geometries. Numerical results computed through the proposed HOC schemes are compared with analytical or established numerical results available in the literature and excellent agreements are found in all the cases. A natural convection problem in a wavy enclosure in presence of magnetic field is studied numerically using the proposed scheme. The left and right walls of the enclosure are wavy whereas the top and bottom walls are straight. The bottom wall is much hotter compared to the side walls whereas the top wall is adiabatic. The effects of the use of porous media are studied. Streamlines and isotherms are plotted with different Rayleigh number, Hartmann number, Prandtl number and Darcy number. The effects of these parameters on the heat transfer rate are also discussed. In order to explore whether a geometry like trapezoidal enclosure enhances the heat transfer rate or not, a mixed convection problem is solved using the proposed HOC scheme. The bottom wall is heated uniformly, the top wall moving with a constant velocity is adiabatic and the inclined walls are at low temperature. The parameters used to describe the flow characteristics and the heat transfer rate are Grashof number, Richardson number and Prandtl number. The influences of height (of the trapezoidal cavity with fixed bottom width) and also the width (of the bottom wall with fixed height) on the fluid flow and the heat transfer rate are discussed. A mixed convection problem in a vented cavity with bottom wavy wall is also included in this thesis work. The inlet is considered at the bottom part of the left wall, the rest part of this left wall is heated with a constant heat flux, the other walls are adiabatic whereas the outlet is at the top portion of the right vertical wall. The effects of parameters such as Rayleigh number, Reynolds number on the fluid flow and the heat transfer rate are discussed. The effects of the number of waves in the bottom wall are also studied. The flow characteristics of an incompressible flow in a dilated channel in presence of magnetic field are also studied in this thesis where the dilated channel is assumed to be either lateral or axisymmetric. The effects of the Hartmann number and the Reynolds number on the flow behaviour are discussed.