"NUMERICAL ANALYSIS OF FLUID FLOW DUE TO FREE CONVECTION IN A LID-DRIVEN CAVITY HAVING A HEATED CIRCULAR HOLLOW CYLINDER"

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SUPERVISOR'S DECLARATION

I hereby declare to the Department of Mechanical Engineering Sonargaon University, Dhaka, Bangladesh that I have checked this "**Numerical analysis of fluid flow due to free convection in a lid-driven cavity having a heated circular hollow cylinder"** and in my opinion this thesis is satisfactory in terms of scope and quality for the partial achievement of the degree of Bachelor of Science in Mechanical Engineering.

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STUDENT'S DECLARATION

This is certified that the work presented in this thesis titled "**Numerical analysis of fluid flow due to free convection in a lid-driven cavity having a heated circular hollow cylinder**" is an outcome of the investigation carried out by authors under the supervision of Md. Sojib Kaisar, Lecturer & Course Coordinator, Department of Mechanical Engineering, Sonargaon University.

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ABSTRACT

Free convection heat transfer induced by the combined effect of mechanically driven lid and buoyancy force in a circular hollow cylinder. In the enclosure, the horizontal walls are maintained an uniform temperature at any point. The present study simulates a realistic system such as heat transfer in heated boiler cell. The governing equations for the problem are firstly transformed into non-dimensional form. The computation carried out with Grashof and Rayleigh number. The analysis is transmitted with the variation of streamlines and isothermals for different Rayleigh number ranging from 10^3 to 10^7 where Prandtl number kept 0.71 constant. Moreover, the results of this investigation are shown by the variation of fluid temperature in the enclosure with the different perimeters (velocity, Pressure).

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Nomenclature:

ρ	Density, kg/m^3
T_h	Hot wall
T_c	Cold wall
k	thermal conductivity
c_p	Constant pressure specific heat, kJ/kg. K
Pr	Prandtl number
F_y	(Ra/Pr)
g	Gravitational acceleration, m/s^2
Gr	Grashof number
Ra	Rayleigh number
T	Fluid temperature
T_∞	Temperature of ambient fluid; cold wall
U	Velocity component in X-direction
V	Velocity component in Y-direction
X	Co-ordinate parallel to the plate
Y	Co-ordinate normal to the plate
μ	Dynamic viscosity
L_{ref}	Reference length
U_{ref}	Reference velocity$\left(\frac{a}{l}\right)$
P_{ref}	Reference pressure, $\frac{\rho\alpha\mu}{L_{ref}}$
T_{ref}	Reference temperature, T_∞
A	Heat transfer area [m2]
Q	Conduction heat transfer [W]
∂_T/∂_x	Temperature gradient [Km-1]
T_s	Absolute temperature of the hot surface [K]
T_∞	Absolute temperature of the cold surface [K]
$T_s - T_\infty$	Temperature difference [K]
h	Convection heat transfer coefficient, W/m^2.K
ε	Emissivity of the surface