

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



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February 2020

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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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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ACKNOWLEDGEMENT

All praise is to Allah swbt. We seek for this help, and we ask for this forgiveness. At first, we would like to express eternal gratitude to him for the successful completion of this study.

We would like to especially thank to our supervisor Md. Sojib Kaisar for his directions assistance and guidance. His kindness and thoughtful directions have made the progress of our thesis much smoother.

Also, we would like to thank Md. Mostofa Hossain, Head of the Department of Mechanical Engineering, to give us the opportunity to carry out our research on such an important topic under our supervisor. We thank our course mate who provided their valuable guidelines in preparing the methodology and results, which was vitally important for the completion of this work.

Last but not the least, we express our indebtedness to this glorious institution, **Sonargaon University**.

Thank You

The Authors

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 [m ²]
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