



NUMERICAL STUDY OF CONVECTION HEAT TRANSFER TO GAS CYLINDERS AND ECONOMICAL ANALYSIS

By

Eng. Mohamed Eid Mohamed Ali

**A Thesis Submitted to the
Faculty of Engineering at Cairo University
In Partial Fulfilment of the
Requirements for the Degree of MASTER OF SCIENCE**

In

MECHANICAL POWER ENGINEERING

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Under the Supervision of

Prof. Dr.Sayed Kaseb
Professor of Mechanical Power
Engineering

Dr.Gamal El-Hariry
Lecturer of Mechanical Power
Engineering

**Mechanical Power Engineering Department
Faculty of Engineering
Cairo University**

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Approved by the Examining Committee

Prof. Dr. Sayed Kaseb
Professor of Mechanical Power Engineering

Chief Advisors

Prof. Dr. Abdel-Wahed El-Dib
Professor of Mechanical Power Engineering

**Internal
Examiner**

Prof. Dr. Eed A. Abdel-Hadi
Professor of Mechanical Power Engineering- Faculty of
Engineering , Benha University

**External
Examiner**

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SYMBOLS AND ABBREVIATIONS

NOMENECLATURE

Symbol	Quantity
Br	Brinkman number, $Br = \frac{\mu U_e^2}{k \Delta T}$
C	Constant
C_p	Specific heat at constant pressure, J/kg.K
D	Distance, m
D_{im}	Diffusion coefficient for species i in mixture m , m ² /s
E	Total energy of a fluid particle, J Dimensionless term describing the turbulent dissipation rate, ε
\vec{F}	External body forces, N
G	Gravitational acceleration, m/s ²
G_b	Generation of turbulent kinetic energy, k , due to buoyancy
G_k	Turbulence kinetic energy production
h	Enthalpy, kJ/kg
h_j^0	enthalpy of formation of species j , J / mol
H	Height, m
I	Unit tensor Fluctuation intensity, W/m ²
\vec{J}_j	Diffusion flux of species j , kg/ m ² .s
K	Turbulent Kinetic energy, m ² /s ²
k	Dimensionless group describing the turbulent kinetic energy.
L_s	Mixing length, m
Le	Lewis number, $Le_i = \frac{k}{\rho c_p D_{i,m}}$
M	Mass, kg
P	Pressure, Pa
Pr	Prandtl Number, $Pr = C_p \mu / k$
Ra	Rayleigh number, $Ra = Gr \times Pr$
Re	Reynolds Number, $Re = \rho U l / \mu$
RH	Relative humidity, %
R_i	Net rate of production of species i