# CONTENTS

# NOMENCLATURE

The following is a list of some of the main symbols used in this thesis:

| | |
|---|---|
| **A** | **Area ($m^2$)** |
| **AR** | **Aspect ratio; H/L** |
| **$B_n$** | **Bingham number** |
| **Cp** | **Constant pressure specific heat; J/kg. K** |
| **x** | **Coordinate direction; m** |
| **y** | **Coordinate direction; m** |
| **$T_c$** | **Cold side temperature; K** |
| **$T_h$** | **Hot side temperature; K** |
| **U** | **Dimensionless velocity** |
| **$D_a$** | **Darcy number; $k_m/H^2$** |
| **$K_f$** | **Fluid thermal conductivity; W/m. k** |
| **$K_s$** | **Solid thermal conductivity; W/m. k** |
| **Gr** | **Grashof number; $g\beta(T_h - T_c)L^3/\nu^2$** |
| **g** | **Gravitational acceleration; $m/s^2$** |
| **H** | **Height; m** |
| **L** | **width; m** |
| **h** | **Heat transfer coefficient; $W/m^2.K$** |
| **$T_h$** | **Hot side temperature; K** |
| **$Nu_y$** | **Local Nusselt number** |
| **Nu** | **Nusselt number; hL/k** |
| **Pr** | **Prandtl number; $\nu/\alpha$** |
| **P** | **Pressure; $N/m^2$** |
| **$T_o$** | **Reference temperature; K** |
| **Ra** | **Rayleigh number; $\beta g (T_h - T_c)L^3/\nu\alpha$** |
| **$\Delta t$** | **Time step; sec** |
| **t** | **Time; sec** |
| **V** | **Volume or dimensionless velocity** |
| **v** | **Velocity component; m/s** |
| **u** | **Velocity component; m/s** |

## Greek Symbols

| | |
|---|---|
| $\rho$ | **Density; $Kg/m^3$** |
| $\mu$ | **Fluid dynamic viscosity; ($N.s/m^2$)** |
| $\alpha$ | **Thermal diffusivity; $k/(\rho c_p)$** |
| $\beta$ | **Volumetric expansion coefficient; $m^2/s$** |
| $\nu$ | **Fluid kinematics viscosity; $m^2/s$** |
| $\gamma$ | **Angle of inclination** |
| $\tau$ | **Dimensionless time; ($t^*\alpha/L^2$)** |
| $\theta$ | **Dimensionless temperature, ($T-T_c / T_h-T_c$)** |

## ABBREVIATIONS

**AFMG** Accelerated Full-Mult-Grid-technique
**CFD** Computational Fluid Dynamics code
**CPU** Central Processing Unit
**IVB** Inverted Bridgman configuration
**PIV** Particle Image Velocimetry
**PCB** Printed Circuit Boards
**SUR** Successive Under Relaxation
**VB** Vertical Bridgman configuration
**PDE** Partial differential equation
**SIMPLC** semi-implicit method for pressure linked-velocity correction
**SIMPLC** semi-implicit method for pressure linked-velocity