NUMERICAL SOLUTION OF FLOW AND HEAT TRANSFER INSIDE HEATING SQUARE CAVITIES .

M. A. Badri

Subsea R&D centre,Isfahan University of Technology,Isfahan,IRAN

ABSTRACT To determine fluid flow specifications , either internal or external , it is necessary to solve for the non-linear Navier stockes and continuity equations .
Here , a field method is used to solve the fluid features . In that , the domain has been discretized to some two-dimentional elements for two dimentional problems .Then ,the Mass and the Momentum conservation laws have been applied to numerically determine cooling of surfaces containing cavities and recess and heat exchange between hot containers in a square cavity .

A finite volume method based on finite difference approach was used for simulation of the governing equations . Studies reveal the significance of lid velocity in heat removal from the cavity .

1. Introduction

Colling of heated containers as mixed convection in cavities have studied before . De Vahl Davis (1983 ,[2]) has studied the heat transfer in a heated cavity with stationary surface .

This problem was analysed under isothermal conditions by Ghia(1982) and under vertical temperature gradient by Iwatsu (1993,[4]) .

The present work which also was done by Raghunandan (1997,[5]) , in a different method , investigates the flow and heat transfer when the top lid is in sliding movement .

2. Governing Equations

The flow is assumed steady and incompresible . Using cartesian coordinate system (x , y) two-dimentional governing equations in non-dimentional form may be expressed as follows :

$$\partial u^* / \partial x^* + \partial v^* / \partial y^* = 0 \qquad (1)$$

$$u^* \partial u^* / \partial x^* + v^* \partial u^* / \partial y^* = -\partial p^* / \partial x^* + \frac{1}{\mathrm{Re}}\left[\frac{\partial^2}{\partial x^{*2}} u^* + \frac{\partial^2}{\partial y^{*2}} u^*\right] \qquad (2\text{-}1)$$

$$u^* \partial v^* / \partial x^* + v^* \partial v^* / \partial y^* = -\partial p^* / \partial y^* + \frac{1}{\mathrm{Re}}\left[\frac{\partial^2}{\partial x^{*2}} v^* + \frac{\partial^2}{\partial y^{*2}} v^*\right] + \frac{Gr}{\mathrm{Re}^2}\theta^* \qquad (2\text{-}2)$$