

REE – 470

Programming Assignment 1

Consider a fluid bounded by two parallel plates extended to infinity such that no end effects are encountered. The walls and the fluid are initially at rest. Now, the lower wall is suddenly accelerated in the x-direction. The Navier-Stokes equations for this problem may be expressed as:

$$\frac{\partial u}{\partial t} = \nu \frac{\partial^2 u}{\partial y^2}$$

It is required to compute $u(t, y)$, by writing a Matlab Code.

Assume initial conditions of

$$u = u_o @ y = 0$$
$$u = 0 @ 0 < y \leq h$$

where h is the distance between the two plates and equals 40 mm.

Assume the following boundary conditions:

$$u = u_o @ y = 0$$
$$u = 0 @ y = h$$

Take $\nu=0.000217 \text{ m}^2/\text{s}$, $u_o=40 \text{ m/s}$, max time of 1.08 sec. Assume 40 nodes in y direction.

Apply the following schemes:

FTCS - Explicit

Calculate and plot the velocity distribution by using Matlab by using the following time steps:

dt = 0.002 sec

dt = 0.00232 sec

dt = 0.003 sec