**Introduction**

After experiencing 2D Navier-Stokes Equation, Navier-Stokes Equation in 3D has been implemented in our group project. C++ framework is replacing the traditional C programming. Then 3D calculation for velocity(u,v,w), force(F,G,H) ,pressure, residual and temperature has been reformed. Due to increase in the complexity of arbitrary geometry in 3D, a new algorithm was implemented. In order to parallelize the program, CUDA solver was built to decrease the runtime to calculate in 3D image. In the following sections, details will be explained and results will be displayed.

**3D incompressible Navier-Stokes equation**

Non-stationary incompressible viscous fluid flow is described in 3-dimensional Navier-Stokes Equation. The analysis was carried out in Cartesian coordinates. The quantities are computed as u,v,w and F,G,H as x,y,z directions. Then the 3D momentum ,continuity equations are:

3D Momentum equations. No:1,2,3

3D Continuity equation. No 4

1. Force F and velocity u calculation in x direction:

Velocity w is essentially considered into the calculation then, the discretization for derivatives of u,v and w has to be with respect to directions x,y and z respectively.

F calculation equation: No6

u calculation equation: No29

1. Discretization for F

The midpoints of 3 directions will be towards to evaluate the derivative of u,v and w:

Equations : No 9 -14

1. Energy equation and Discretization

The energy equation in 3D and its discretization are easy to compute

Energy equation: No 32

Discretization: No 33 and 36

1. SOR Solver

Pressure equation: No 27

Residual: No 28

**Boundary Conditions**

**Arbitrary Geometries**