

# Progress Report

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2018.05.16

## **1 Finite Volume Navier-Stokes solver**

### **1.1 Final results for equal grid intervals**

A finite volume Navier-Stokes solver was coded in C++. The final results for various grid sizes are shown in the figures below.

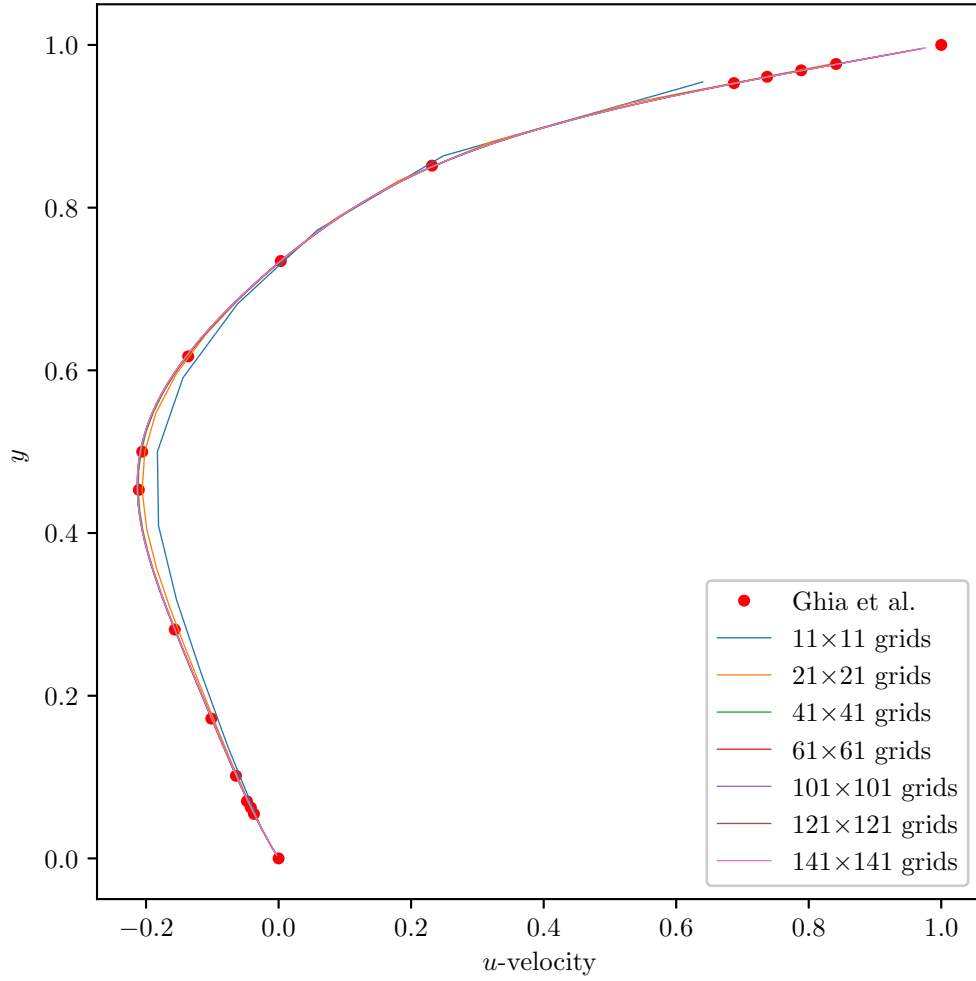


Figure 1:  $x$ -direction velocities at the center of  $x$ -axis are plotted against  $y$ -coordinates for various grid sizes, and compared with the results of Ghia et al.

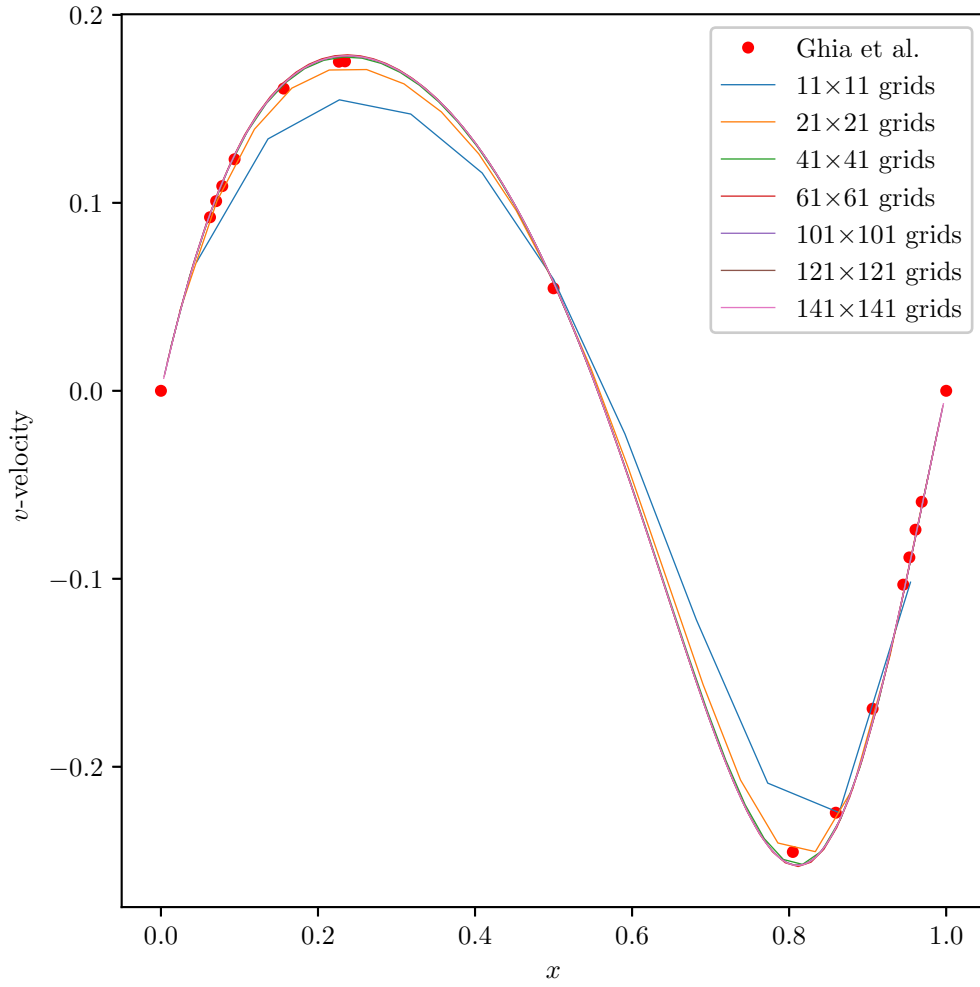


Figure 2: y-direction velocities at the center of y-axis are plotted against  $x$ -coordinates for various grid sizes, and compared with the results of Ghia et al.

The code has been modified to produce data files in a format that can be used in ParaView for plotting requirements. The velocity vector plot produced using ParaView is shown below.

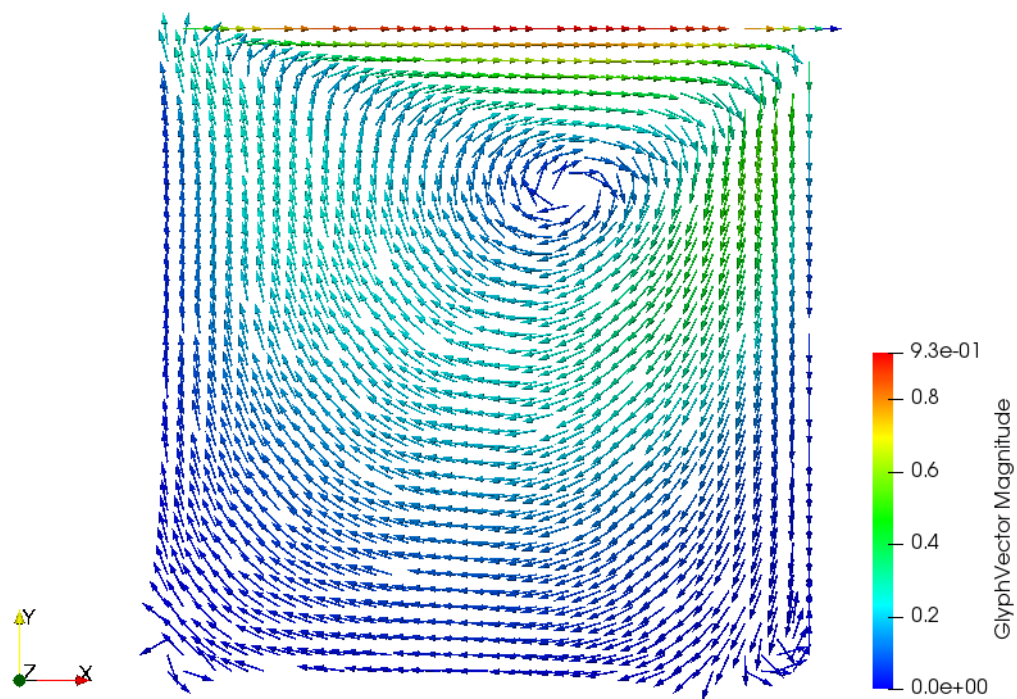


Figure 3: Velocity vectors plotted using ParaView

## 1.2 Results for unequal grid intervals

A grid with unequal grid intervals was used to test the code. The results are shown in the figures below.

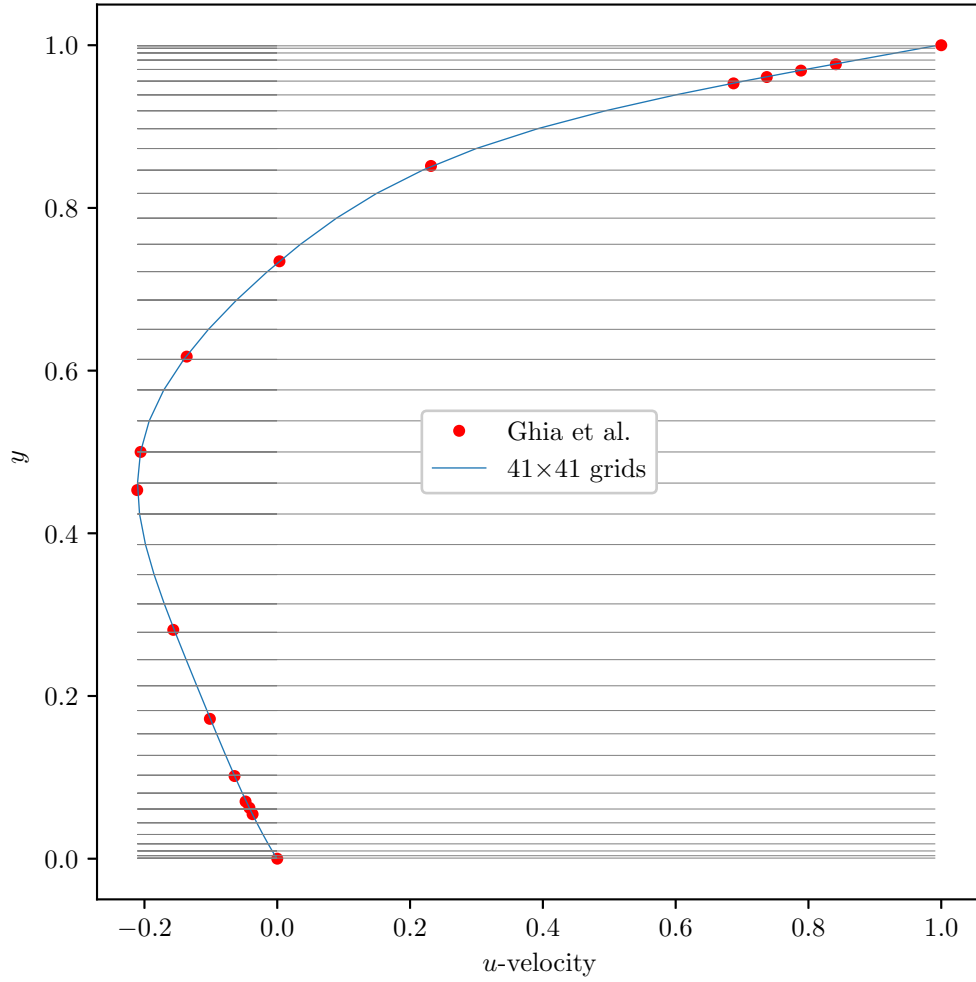


Figure 4:  $x$ -direction velocities at the center of  $x$ -axis are plotted against  $y$ -coordinates for unequal grid sizes, and compared with the results of Ghia et al.

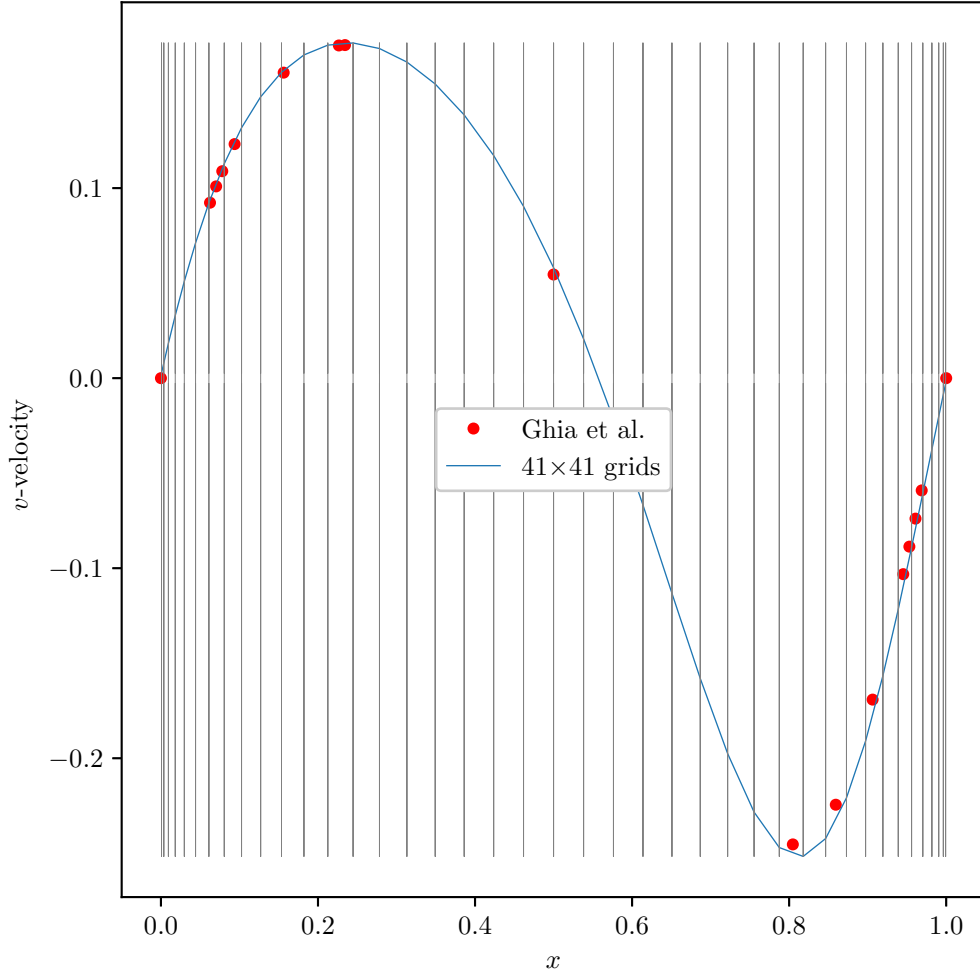


Figure 5:  $y$ -direction velocities at the center of  $y$ -axis are plotted against  $x$ -coordinates for unequal grid sizes, and compared with the results of Ghia et al.

### 1.3 Ongoing tasks

1. Calculating the virtual force for a cylinder inside a lid-driven cavity
2. Converting the code for use with parallel computing using OpenMP
3. Solve cavity-driven flow for 3D