



Simple  
problems

Miklós  
BALOGH  
and Josh  
DAVIDSON

Last week

This week

Assignments

# Laboratory Session 3

## Open-Source CFD Course 2020

Miklós BALOGH and Josh DAVIDSON

2020



# Last week's lab – Refined lid-driven cavity

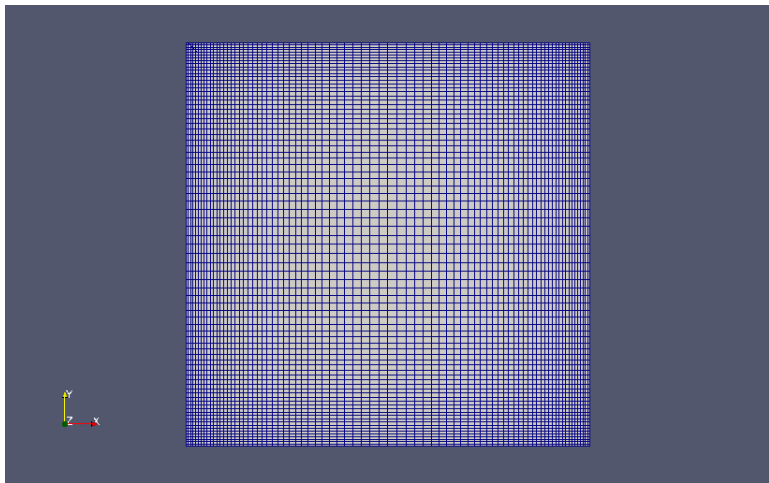
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# Last week's lab – Laboratory tasks

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Assignments

- 1 Modify the cavityGrade case and run (via bash script)
  - Modify system/blockMeshDict (to have a fine, graded mesh)
  - Modify system/controlDict (according to the CFL)
  - Create the mesh
  - Map the fields from the simple cavity case
  - Run the simulation
- 2 Visualize the results of cavityGraded case
  - Velocity map with vectors
  - Streamlines colored by the velocity
  - Mesh



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# Last week's lab – blockMesh

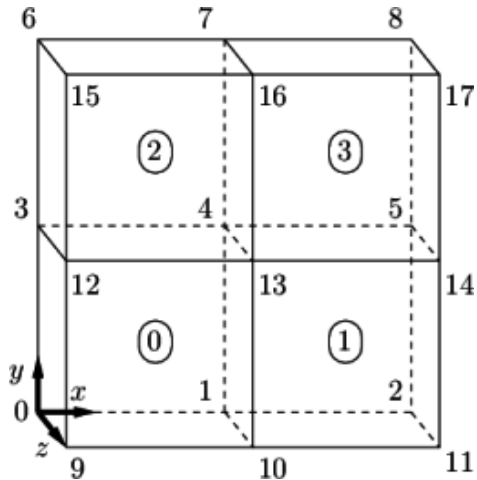
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# Mapping fields in OpenFOAM

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Assignments

- One can initialize a simulation with former results
  - obtained even on lower resolution,
  - via interpolating the fields to the new mesh

```
cd $FOAM_RUN/tutorials/incompressible
cd icoFoam/cavity
blockMesh > blockMesh.log
icoFoam > icoFoam.log
cd ../cavityGrade
blockMesh > blockMesh.log
mapFields ../cavity -consistent
icoFoam > icoFoam.log
```



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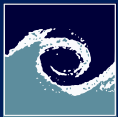
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# Last week's lab – Velocity map with vectors

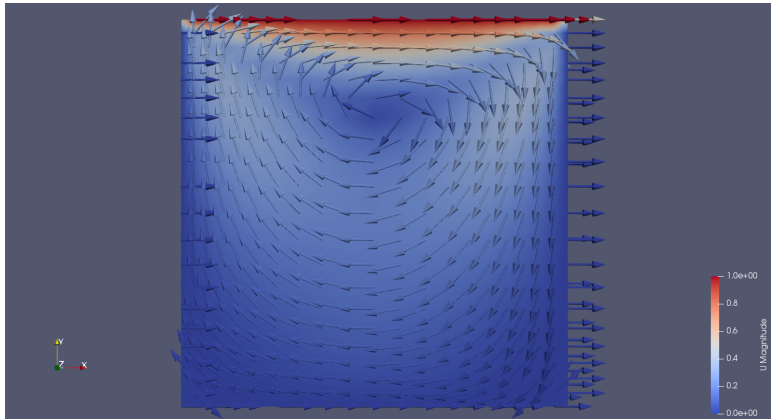
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# Last week's lab – Streamlines

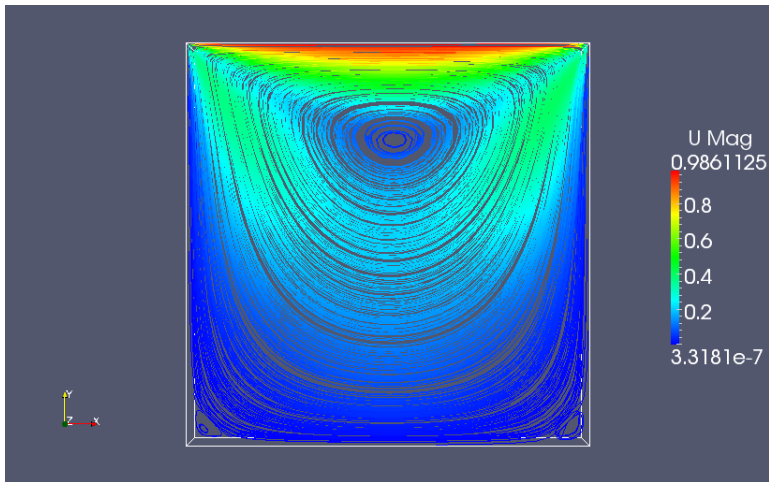
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# Last week's lab – Mesh

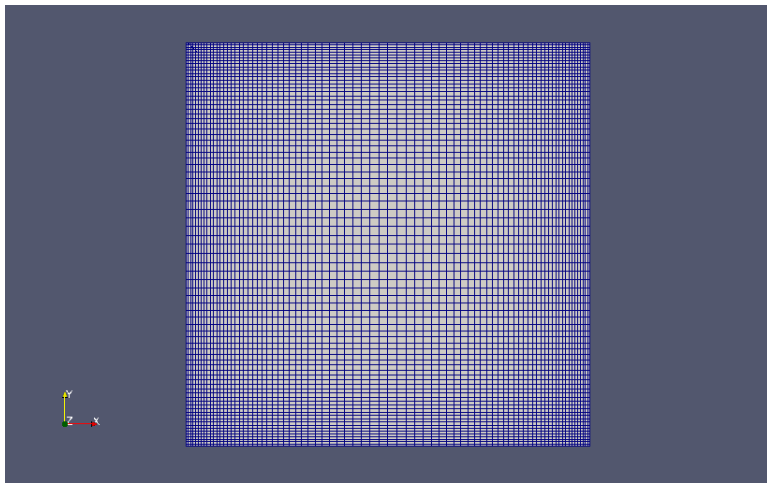
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# This week's lab

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**This week**

Assignments

- 1 Increased Reynolds number
- 2 Clipped geometry

For step-by-step instructions see :

<https://cfd.direct/openfoam/user-guide/v7-cavity/>



# Laboratory tasks

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Assignments

## High Reynolds number

Increase the Reynolds number by a factor of 10 (use the *cavityGraded/fine* mesh case)

$$Re = \frac{\rho v L}{\mu}$$

- 1 Decrease the dynamic viscosity by 10
  - The dynamic viscosity is represented by the variable *nu* in the *constant/transportProperties* file
- 2 Increase the lid velocity by 10
  - The velocity is defined in the boundary condition for *movingWall* in the *0/U* file
- 3 Run the simulations, analyse and compare the results



# This week's lab – Clipped lid-driven cavity

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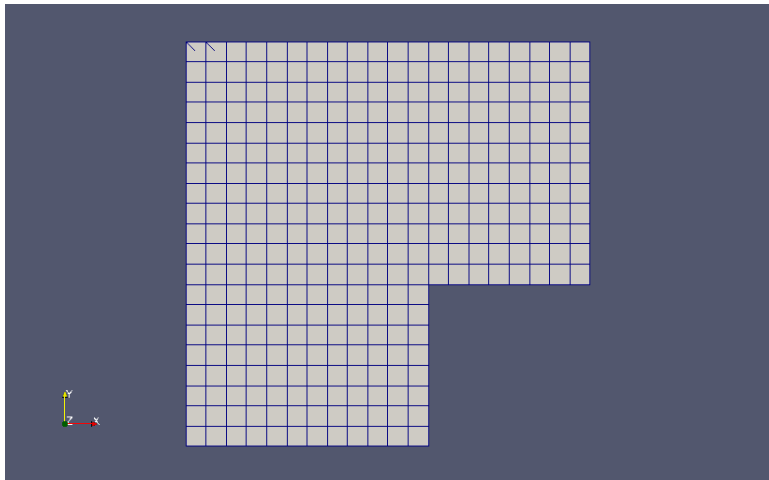
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Assignments

The case consists of the standard cavity geometry but with a square of length 0.05 m removed from the bottom right corner.





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Assignments

- 4 Modify the cavityClipped case (in the *OpenFOAM Tutorials* directory), which has a square of length 0.04m removed from the bottom right corner, to consider the cases where the square has a length of 0.03m and 0.05m.
- 5 Run the modified cases and compare them to the original cavityClipped case



# Assignments

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Assignments

- 1 Does the run time increase for the High Reynolds case compared to the original case? If so by how much? Which case has the longest run time and why?
- 2 Provide a visual comparison of the two High Reynolds and the original case.
- 3 Provide a visual comparison of the three cavityClipped cases (0.03m, 0.04m and 0.05m box)