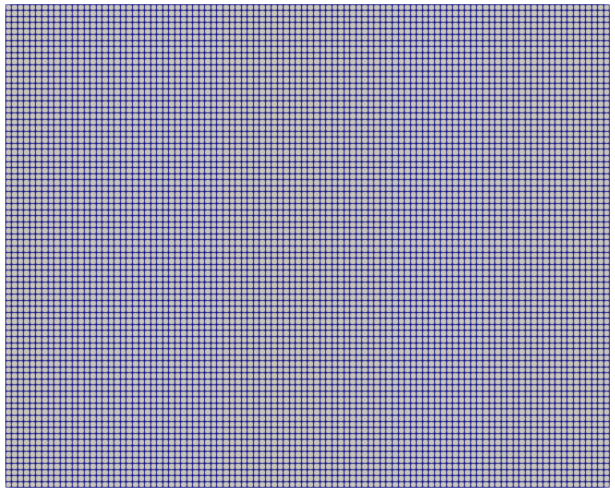
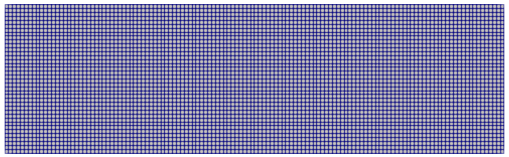


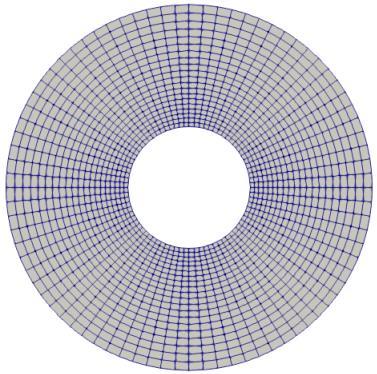
Component mesh 1

+



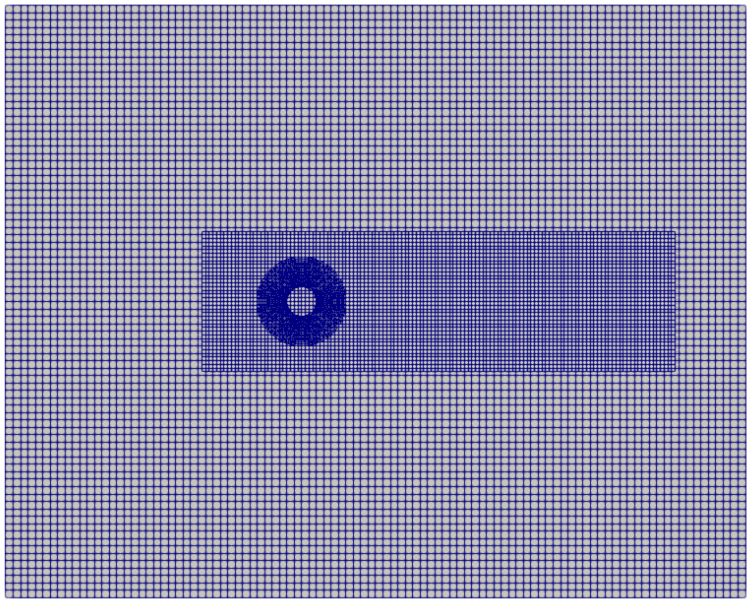
Component mesh 2

+

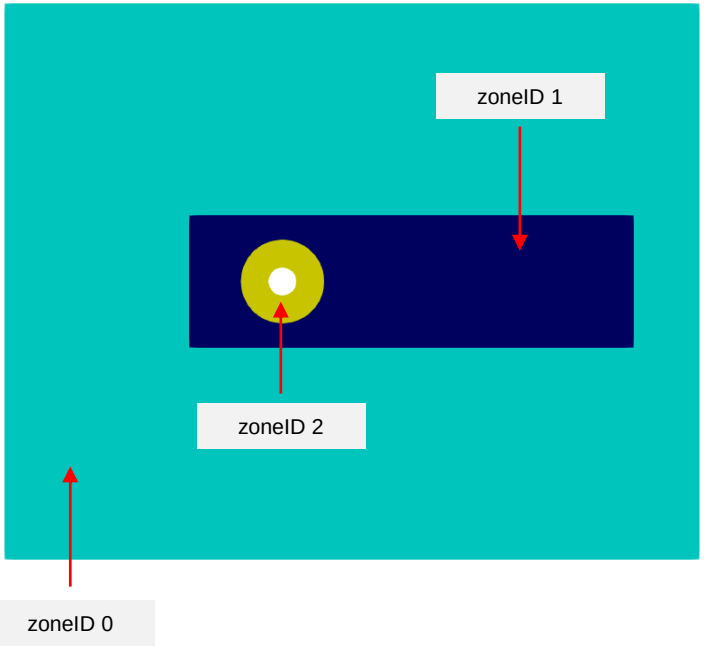


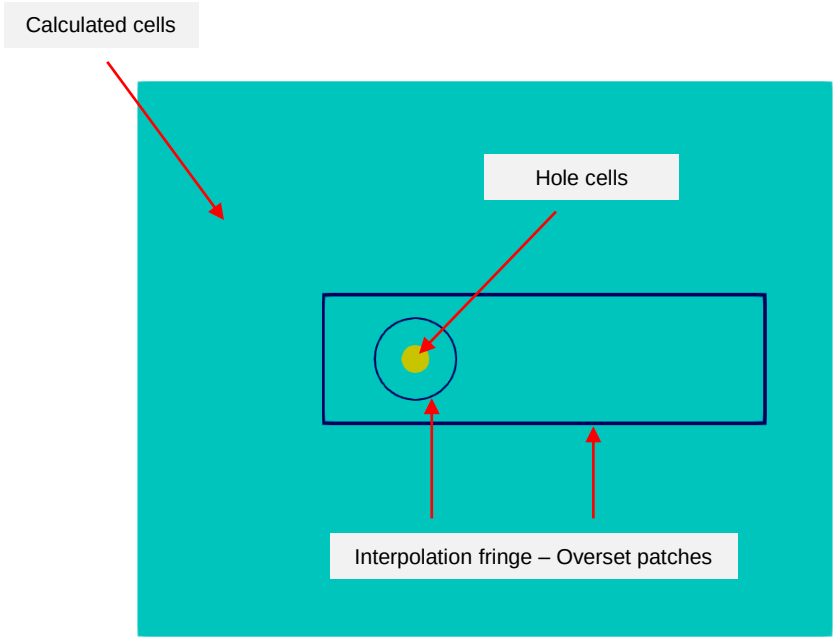
Component mesh 3

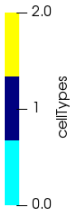
=



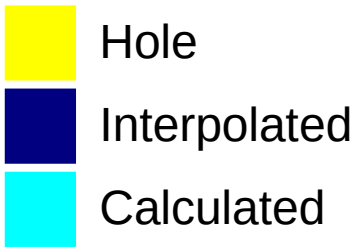
- The cell type can be any of the cells supported by OpenFOAM®.
- The meshes can be 2D and 3D.
- The meshes can be generated using any meshing utility (OpenFOAM® or third-party library).

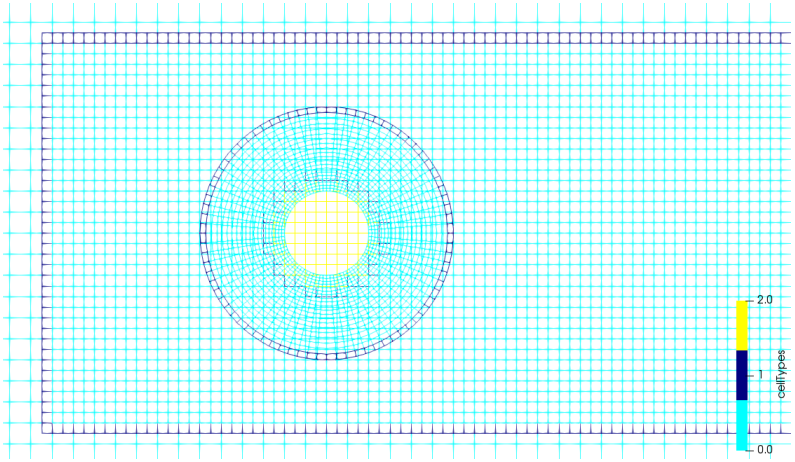




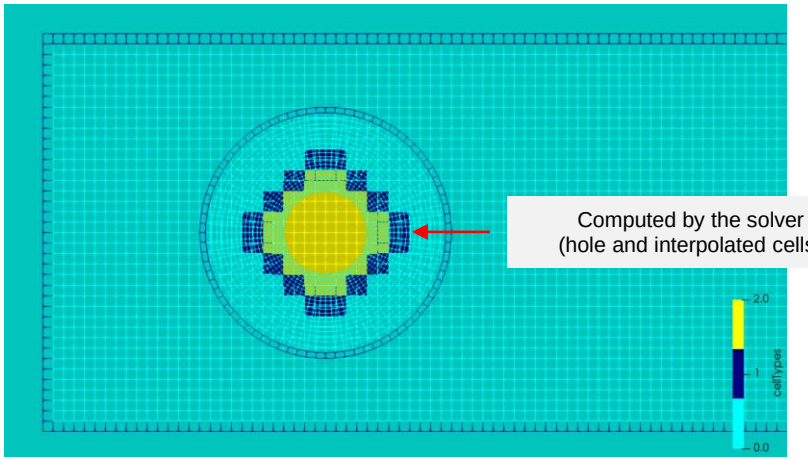


- A zone identification (zoneID) is assigned to each component mesh.
- It is a good practice to assign zoneID 0 to the background mesh.
- The background mesh is the mesh that does not have interpolation cells or the one that is not moving.
- The interpolation fringe between meshes is set by the user, whereas, the interpolation fringe close to the walls, as well as the hole cells, are computed automatically by the overset solver.
- The cell types are defined as follows:
  - In **hole** cells, the solution is not computed.
  - In **interpolated** cells, the solution is interpolated from mesh to mesh.
  - In **calculated** cells, the solution is computed. These cells also serve as donor/receptors.

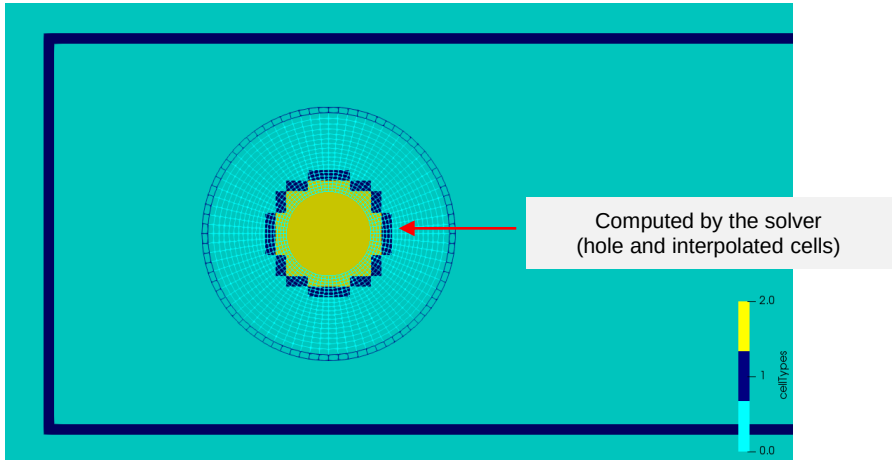




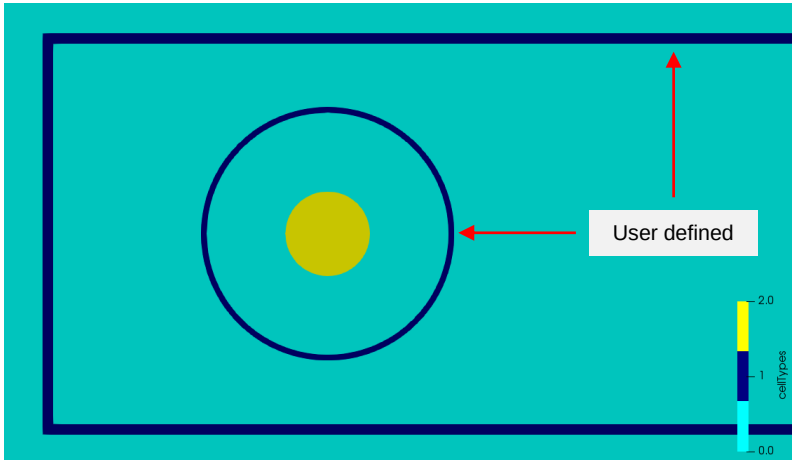
Wireframe visualization – All component meshes



Wireframe visualization – Component mesh 2 and 3



Wireframe visualization – Component mesh 3



Contour visualization – All component meshes

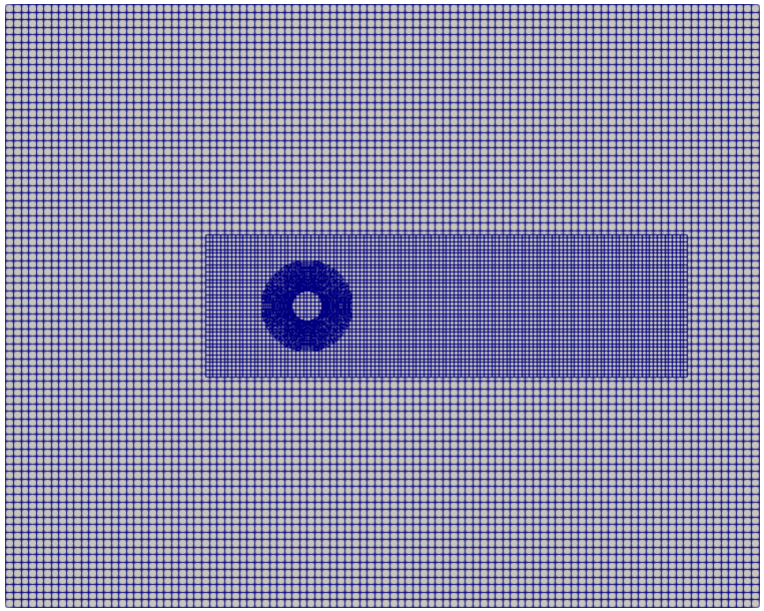
- Cells size close to interpolated cells should be of the same size to minimize interpolation errors.
- It is recommended to have at least four cells between walls and interpolated cells.

Hole

Interpolated

Calculated

Overset meshes simulation workflow in OpenFOAM



Step1
Assemble meshes
Done by the user

Step 2
Create zones
Done by the user

Step 3
Compute stencils and assign cell type
Done by the overset solver

Step 4
Compute solution in each component mesh and interpolate solution
Done by the overset solver

Step 5
Postprocessing, which is a little bit more tedious than working with single meshes
Done by the user

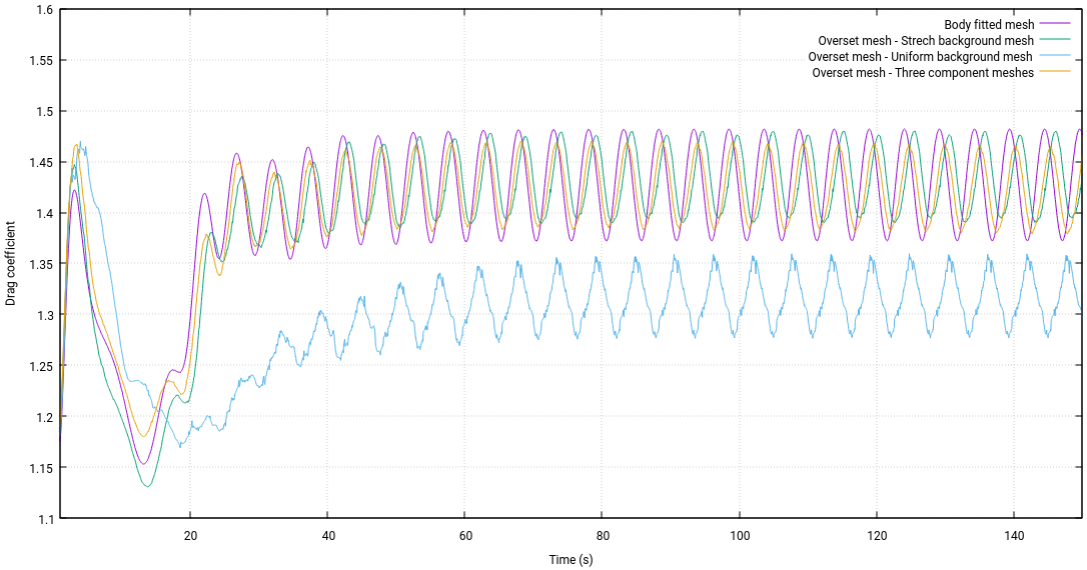
Flow about a fixed cylinder using overset meshes

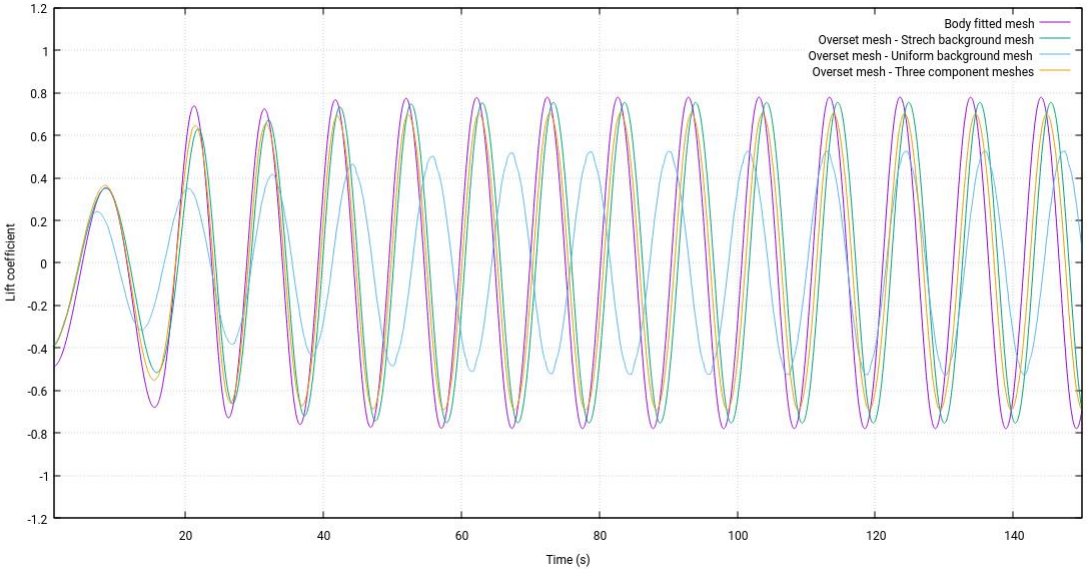
Overset mesh – Uniform background mesh – Two component meshes

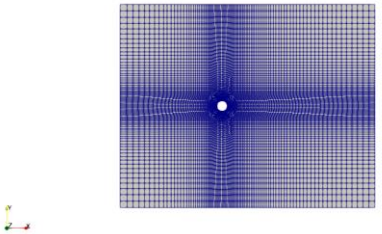
Overset mesh – Stretched background mesh – Two component meshes

Overset mesh – Three component meshes

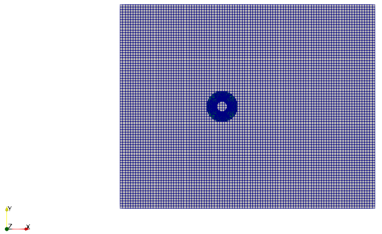
Flow about a fixed cylinder using overset meshes



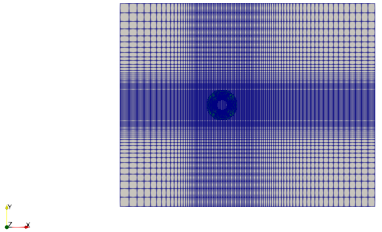




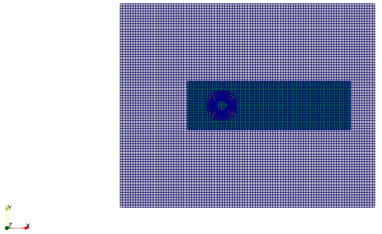
Single body fitted mesh



Overset mesh – Uniform background mesh – Two component meshes

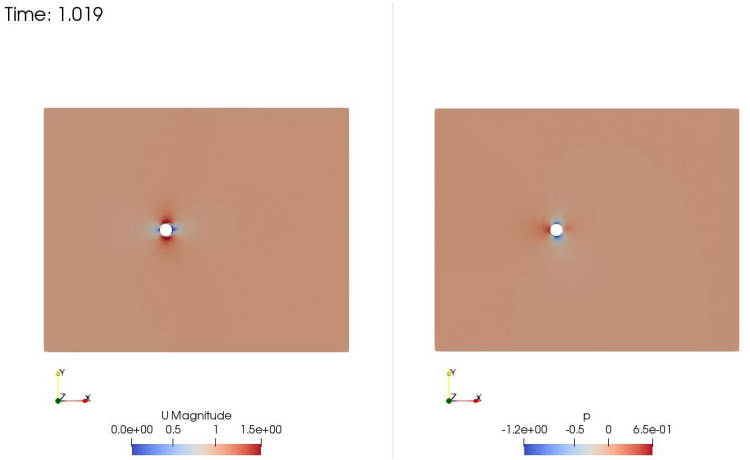


Overset mesh – Stretched background mesh – Two component meshes

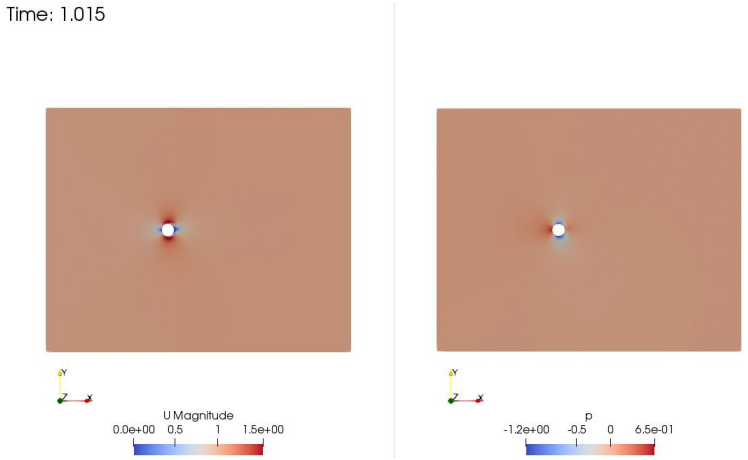


Overset mesh – Three component meshes

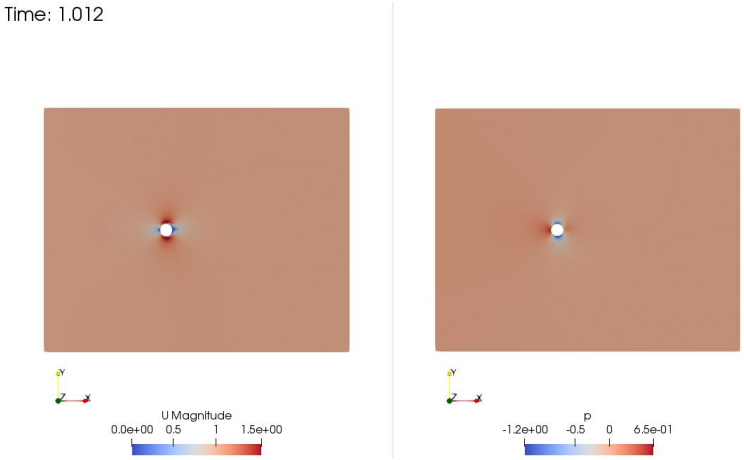
Flow about a fixed cylinder using overset meshes



Two component meshes – No stretching in the background mesh
http://www.wolfdynamics.com/training/dynamicMeshes/overset6.gif

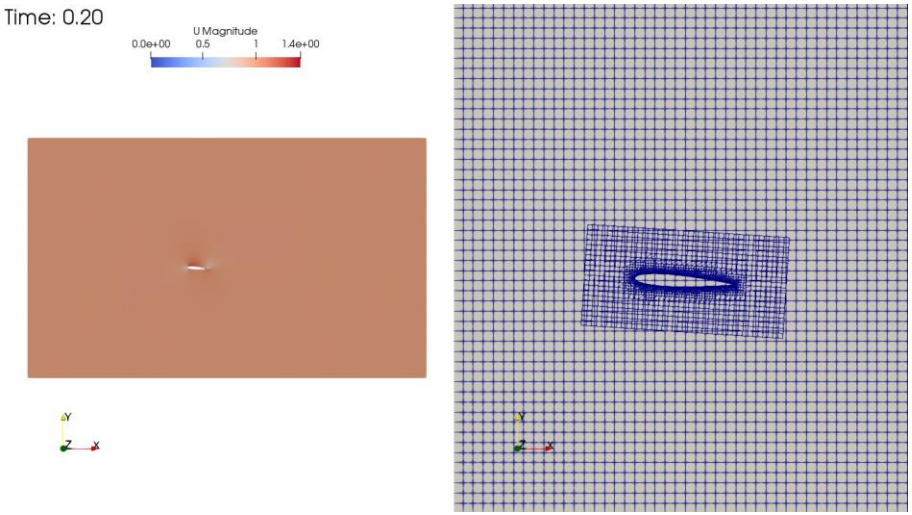


Two component meshes – Stretching in the background mesh
http://www.wolfdynamics.com/training/dynamicMeshes/overset5.gif

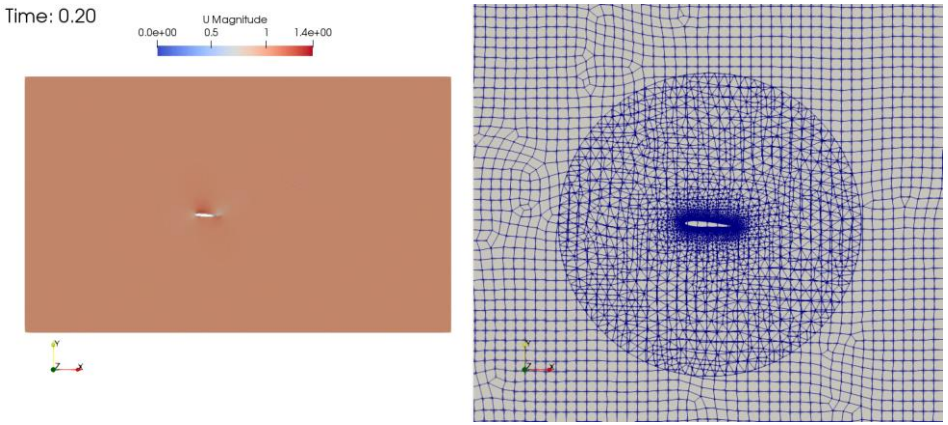


Three component meshes – Stretching in the background mesh and refinement component mesh
http://www.wolfdynamics.com/training/dynamicMeshes/overset7.gif

Moving bodies with overset meshes



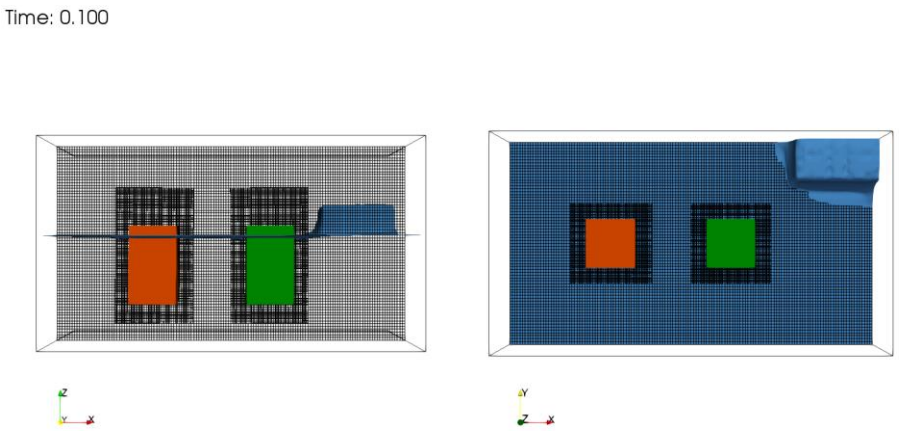
http://www.wolfdynamics.com/training/dynamicMeshes/overset4.gif



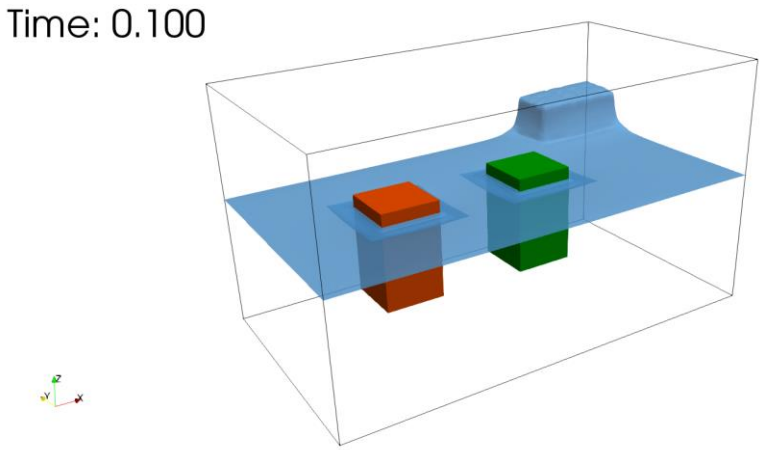
http://www.wolfdynamics.com/training/dynamicMeshes/overset3.gif

Flapping airfoil undergoing prescribed heaving and pitching motion

Moving bodies with overset meshes



http://www.wolfdynamics.com/training/dynamicMeshes/floating_overset1.gif

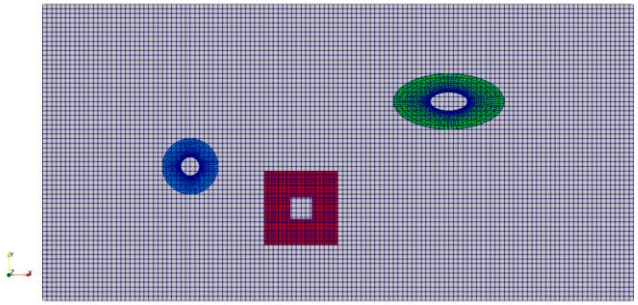


http://www.wolfdynamics.com/training/dynamicMeshes/floating_overset2.gif

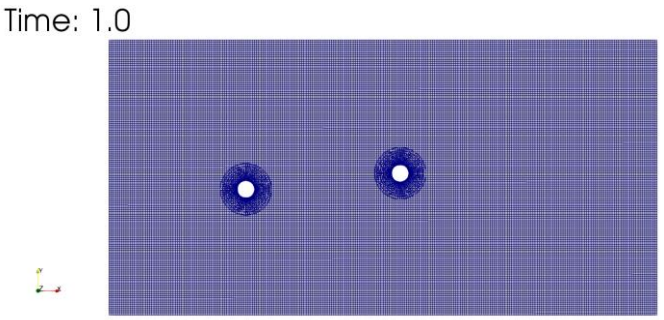
Rigid body motion with multiple bodies

Final comments on overset meshes

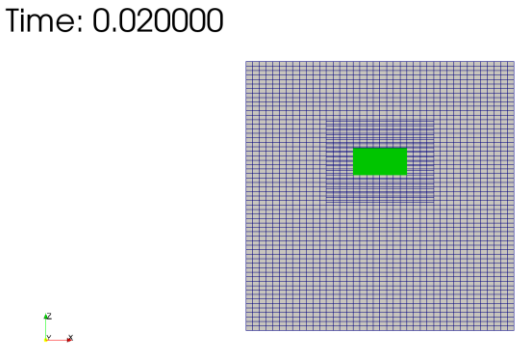
- Overset meshes are very handy when you are dealing with moving bodies.
- There even more handy when you are working with multiple bodies undergoing different motions and rigid body motion with large displacements.
- Overset meshes are fine to use with fixed bodies, however, remember that you will pay an extra computational price due to the computation of the interpolation between meshes.
- If you are working with fixed bodies, overset meshes may become really handy if you are conducting parametric studies where you need to change the position of the bodies or add/remove bodies from the domain (e.g., urban environment simulations).



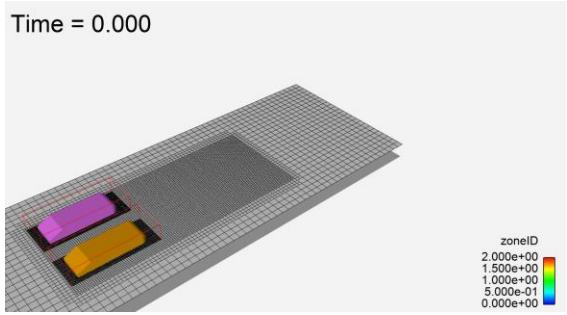
http://www.wolfdynamics.com/training/dynamicMeshes/overset1.gif



http://www.wolfdynamics.com/training/dynamicMeshes/viv2.gif



http://www.wolfdynamics.com/training/dynamicMeshes/overset_rbm1.gif



http://www.wolfdynamics.com/training/dynamicMeshes/overtake1.gif

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- Follow-up problems, questions, and suggestions at guerrero@wolfdynamics.com