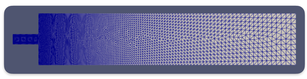
Finite Element Stokes and Navier-Stokes Flow Using GMSH and Ferrite.jl

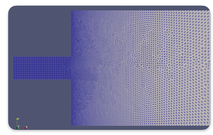
Geometry Definition and Mesh Generation

Problem Description

- **Rectangle: built-in Ferrite using either triangles or quads**
- **Tank with nozzle 2D: GMSH**
- **Wedge and lining: in progress**

Naive Mesh Generation of 2D Geometry of Tank and Nozzle



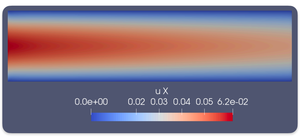


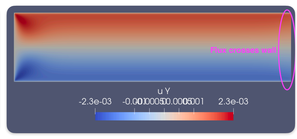
Stokes Flow

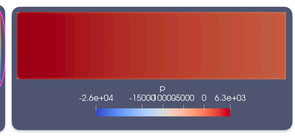
Problem description

- **steady state - only diffusion (no convection)- linear problem**

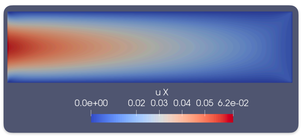
Stokes In Flow into Rectangular Channel With Open End

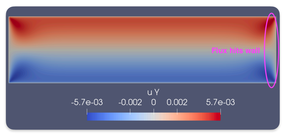


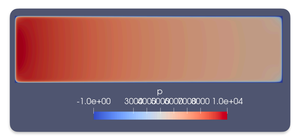




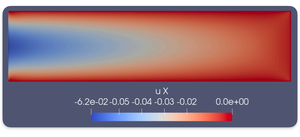
Stokes In Flow into Rectangular Vessel With Closed End

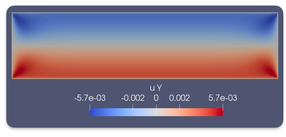


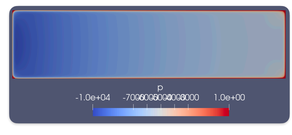




Stokes Out Flow from Rectangular Vessel With Closed End



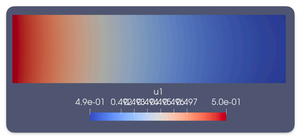




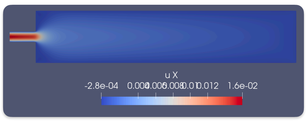
Remarks

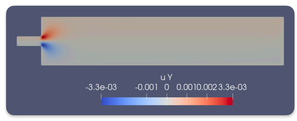
- **Scaling the viscosity leaves velocity unaffected but scales the pressure with the same factor. Larger viscosity values yields smaller peak pressure values values. Hand coded post processing on a rectangular geometry works well to show this;**

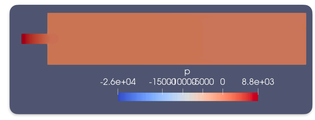
Transport of a Passive Scalar in Post-Processing Stage of the Flow



Stokes Flow on 2D Geometry of Tank and Nozzle





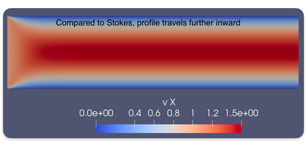


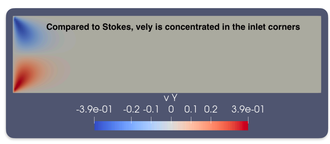
Navier-Stokes Flow

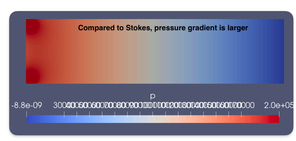
Problem Description

- **Transient problem - time stepping until reaching steady state - Jacobian available**
- **Time step controlled adaptively and influenced by factors such as mesh width, inlet velocity and viscosity;**

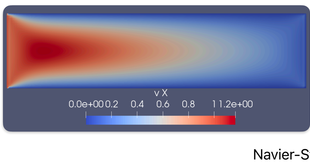
Navier-Stokes Flow in Open Channel

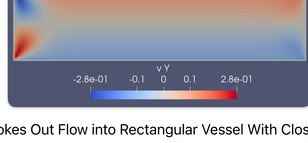


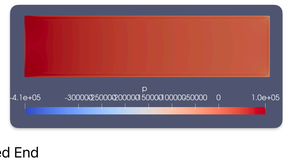




Navier-Stokes In Flow into Rectangular Vessel With Closed End







Navier-Stokes Out Flow into Rectangular Vessel With Closed End