Homework #1, Task 1,2 of 3

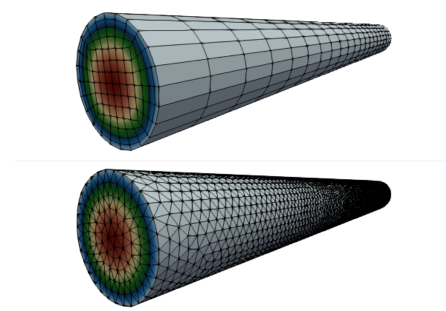
- Task 1: Run Nalu/reg_tests/test_files/dgNonConformalThreeBlade
  a. Modify the input file to increase termination_step_count to ~500.
  b. Visualize the flow field with displacements activated and provide a single image at the final step count.
  c. How does modification of the blade rotation (omega) affect the time step?
  d. Report any modifications that resulted in catastrophic behavior, i.e., the simulation diverged. Document how you caused the simulation to diverge.
- Task 2: Run Nalu/reg_tests/test_files/fluidsPmrChtPeriodic
  a. Modify the input file to increase termination_step_count to ~500.
  b. Visualize the temperature, velocity, and radiative file (your choice) and provide a single image at the final step count.
  c. Modify the gravity constant such that the Rayleigh number 10x, 100x, etc. Report any findings; does the code benefit from a modification of initial time step size? What happens if you change the velocity hybrid parameter to: velocity: 0.0

Notes:

1. If the /mesh directory is empty: Nalu/reg_tests/mesh, then you will need to download the mesh files from: https://github.com/NaluCFD/NaluMesh
2. Make sure that the paths to the xml and mesh file are modified!

Homework #1 Task 3: Specified Pressure Drop Laminar Pipe Flow:

- Location: https://github.com/spdomin/Present/tree/master/stanfordMe469/hw/one
- You will modify the input file to provide the density, viscosity and pressure drop to achieve $Re^{\tau} = 10$ and report on the differences between the simulation and analytical centerline velocity.
- Specifications:
  - $Re^{\tau} = 10$
  - Pipe diameter, D = 0.01 m
  - Pipe Length, L = 0.2 m



a. Perform a global momentum balance to determine the pressure gradient. dp/dz as a function of the wall shear stress , τ_w.

b. Given $Re^{\tau} = \rho u^{\tau} D / \mu$ and $\tau_w = \rho (u^{\tau})^2$, where u^{τ} is the wall friction velocity, report the required pressure gradient required for the desired $Re^{\tau} = 10$.

c. Modify the input file to specify the proper density, viscosity and open pressure specification (look for the pressure specification under open_user_data).

d. Run both the Hex8 and Tet4 input file and compare the simulation centerline velocity to the analytical result (feel free to derive or simply report the functional form).

e. Capture any findings between the Hex8 and Tet4 simulation, e.g., simulation time, velocity component qualitative differences, convergence, etc.