



- 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 (ω) 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.
 - e. See the next page (page 2) for a submission script example

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. This input file was designed to be run within the regression test environment and not as a stand-alone case. You may copy over the file(s) or specify a direct path:

muelu_xml_file_name: /opt/ohpc/pub/apps/nalu/build/Nalu/reg_tests/xml/milestone.xml

mesh: /opt/ohpc/pub/apps/nalu/build/Nalu/reg_tests/mesh/threeBladeMesh.g

2 Example Submission Script: one node, 16 cores



```
#!/bin/bash
```

```
#SBATCH -J test                # Job name
#SBATCH -o job.%j.out          # Name of stdout output file (%j expands to jobId)
#SBATCH -N 1                   # Total number of nodes requested
#SBATCH -n 16                  # Total number of mpi tasks requested
#SBATCH -t 00:15:00            # Run time (hh:mm:ss)
```

```
PROG="/opt/ohpc/pub/apps/nalu/build/Nalu/build/naluX"
ARGS="-i dgNonConformalThreeBlade.i -o output.log"
```

```
### -----
### BEGINNING OF EXECUTION
### -----
```

```
mpiexec $PROG $ARGS
```



- 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?
 - d. 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 as with task #1

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



- Location: <https://github.com/spdmain/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, $L = 0.1$ 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.

