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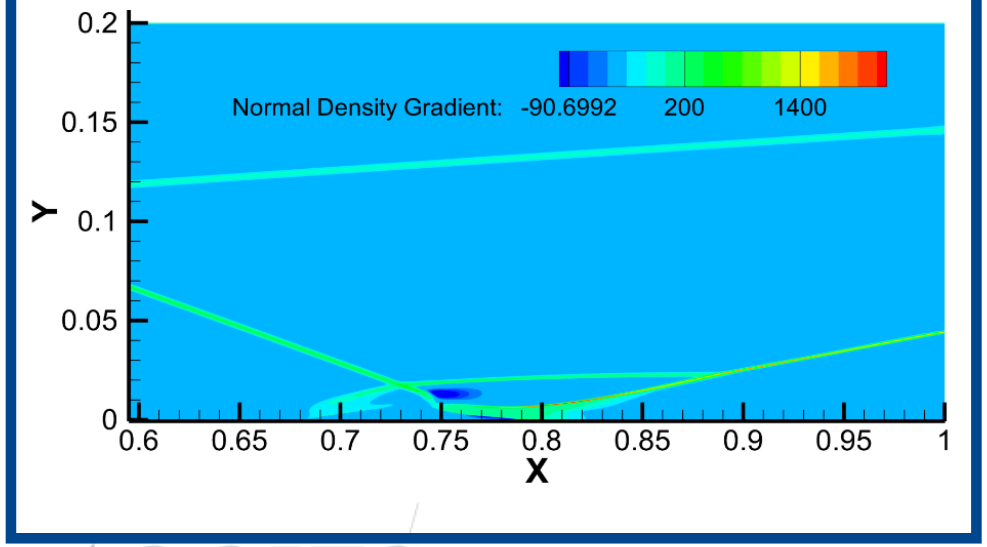
Department: *Mechanical Engineering*

Title: *Investigation of the Flow Features Capturing Capabilities of the Integro-Differential Scheme (IDS)*

Mayor Professor: *Dr. Frederick Ferguson*



RESEARCH QUESTIONS / PROBLEMS:

- Computational Fluid Dynamics (CFD) delivers an approximate solution of governing equations. However, simplifications and assumptions are needed to build numerical models. These models contain uncertainties and errors that are difficult to quantify.

METHODS:

- We implement a novel technique called IDS which is built on a unique combination of the differential and integral forms of the Navier-Stokes Equations, levering HPC platforms and implementing a set of Flow Feature Extraction Functions.

RESULTS / FINDINGS:

- We demonstrated the novel scheme is robust, stable and accurate under realistic conditions.
- Flow Feature Extraction Functions eliminate the uncertainties and speculation when complex and large data set are studied.

SIGNIFICANCE / IMPLICATIONS:

- This work demonstrates accurate solution can be obtained without including numerical models and the numerical solution recover the physics expected, for example: supersonic flows with strong and weak shock waves.