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Department: Mechanical Engineering

Dissertation Title: An Error Analysis of the Integral Differential Scheme Navier-Stokes Solver

Major Professor: Dr. Frederick Ferguson

RESEARCH QUESTIONS / PROBLEMS:
The goal of this dissertation is to establish the accuracy of the Integral Differential Scheme (IDS) solver as a means of establishing the credibility of its solutions. This is done by

• Evaluation of the Spatial Error Behavior of the IDS
• Evaluation of the Temporal Error Behavior of the IDS

METHODS:

• In lieu of analytical methods, a set of numerical experiments were created and implemented to analyze the error behavior.

• Numerical Exact Solutions (Standard Solutions) were obtained from grid independent solution coupled to a Spline tool

• Spatial and Temporal error analysis were performed using the standard solutions and various error norms.

RESULTS / FINDINGS:

• The IDS delivers 1st order discretization accuracy for coarse grids
• As the grids are refined, the error approaches 2nd order accuracy
• The IDS is capable of producing exact solutions for unsteady problems.

SIGNIFICANCE / IMPLICATIONS:

• The results from IDS implementation can now be considered credible.
• This methodology is applicable to error analysis of complex schemes.

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