NASA SBIR/STTR Technologies

Implicit Higher Order Temporal Differencing for Aeroacoustic and CFD Applications

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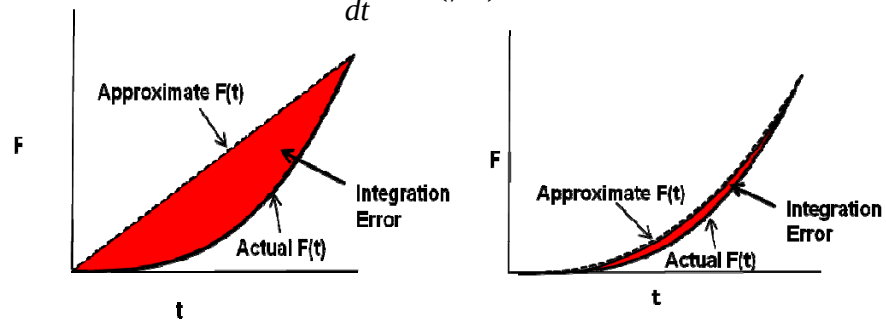
Identification and Significance of Innovation

- Various CFD solvers and applications require high fidelity temporal accuracy. HOD is an effective means of achieving this.
- Creation of a single temporal integrator that can interface with different CFD codes is a better solution than incorporating HOD into various codes.
- Proposed temporal solver will allow arbitrary accuracy.
- Beginning of Phase 1 TRL 2
- End of Phase I TRL 4

$$\frac{d\phi}{dt} = F(\phi, t)$$



2nd Order Higher Order

Technical Objectives and Work Plan

- Develop a stand-alone implicit temporal solver capable of arbitrarily high order of accuracy, using the Spectral Deferred Correction (SDC) approach.
- Start with SDC algorithm in Existing Code
- Create a Separate Temporal Integrator that can interface with various CFD and other numerical analysis codes.
- Develop Interface Protocols
- Demonstrate Proof-of-concept with FV Thermal Solver
- Further development in Phase II – parallel, segregated solvers, operator splitting schemes.

NASA and Non-NASA Applications

The proposed solver will allow implicit higher order temporal differencing to be incorporated into various numerical analysis codes. This is especially critical for higher order spatial differencing schemes that tend to be much stiffer than lower order schemes.

The solver can be extended to incorporate operator splitting techniques, for efficient solution of reacting gas dynamics.

The algorithm is not limited to CFD applications, in fact any numerical solver with a first order temporal term can be coupled with this solver.

NON-PROPRIETARY DATA