Strand and Cartesian Grids: A Pathway Forward for Massively Parallel CFD

Thursday, March 27, 2014, 3:30P.M.

Lower Level Auditorium, Geddes Hall

Refreshments served at 2:45 p.m. in the AME Conference room, 365C Fitzpatrick

While many problems in computational fluid dynamics (CFD) may be solved with modest computational resources, other problems, such as wind farm simulation, require high performance computing (HPC) to adequately resolve flow and geometric complexity. However, merely applying old methodology to larger problems is an inefficient approach that does not readily take advantage of tremendous advances in computer hardware over the past few decades. The purpose of this talk is to highlight new approaches for handling computationally intense, Big Data problems in CFD by rethinking CFD from the ground up. Beginning with a new mesh paradigm based on "strand" and Cartesian grids, these approaches have been developed to support the Department of Defense CREATE program, primary sponsor of the Helios simulation code. The purpose of strand and Cartesian grids is to enable massively parallel simulations of variable Reynolds number, vortex dominated flows over complex geometry through a compact mesh description that facilitates automatic adaptation to critical flow features. Novel high-order methods are introduced for strand grids that circumvent many of the difficulties encountered with discontinuous Galerkin and related schemes introduced in recent years. New unsteady preconditioning and multigrid-in-time strategies are discussed with the potential to extend parallelism to the time domain (not just space) for long time integration problems, such as LES simulations.

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If you are interested in meeting individually with Dr. Katz, please contact Linda at 631-5431.