PRINCETON
Mechanical & Aerospace Engineering

Friday, April 28, 2017
Maeder Hall, ACEE
3:30 PM

PyFR: High-Order Accurate Cross-Platform Petascale Computational Fluid Dynamics with Python

Freddie Witherden
Stanford University
Stanford, CA

High-order numerical methods for unstructured grids combine the superior accuracy of high-order spectral or finite difference methods with the geometrical flexibility of low-order finite volume or finite element schemes. The Flux Reconstruction (FR) approach unifies various high-order schemes for unstructured grids within a single framework. Additionally, the FR approach exhibits a significant degree of element locality, and is thus able to run efficiently on modern many-core hardware platforms, such as graphics processing units (GPUs). The aforementioned properties of FR mean it offers a promising route to performing affordable, and hence industrially relevant, scale-resolving simulations of hitherto intractable unsteady flows within the vicinity of real-world engineering geometries. In this talk we will present PyFR an open-source, Python-based framework for solving the Navier-Stokes equations using the FR approach at extreme scale. Results will be presented for various benchmark and "real-world" flow problems, and scalability/ performance of PyFR will be demonstrated on clusters with thousands of NVIDIA GPUs. Current challenges and future directions within computational fluid dynamics, and computational mechanics in general, will also be discussed.

Freddie Witherden studied Physics with Theoretical Physics at Imperial College London between 2008–2012 earning an MSci degree with first class honors. In September of 2012 Freddie started a PhD in computational fluid dynamics in the department of Aeronautics at Imperial College London under the supervision of Dr Peter Vincent and graduated in December 2015. Early in 2016 Freddie started a postdoctoral appointment in the department of Aeronautics and Astronautics at Stanford University under the supervision of Prof. Antony Jameson. Freddie's main research interests are in the development new and novel approaches to enable the simulation of hitherto intractable flow problems at extreme scale.

Social Period outside of Maeder Hall following the seminar

ALL VISITORS ARE WELCOME