MECHANICAL ENGINEERING SEMINAR

"Challenges in CFD Simulation for Engineering Applications"

David Philips
Research Scientist, Cascade Technologies

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Abstract: Computational Fluid Dynamics (CFD) simulation has great potential to impact a broad range of engineering applications involving fluid flow. Nevertheless, fundamental challenges remain in all phases of the simulation process from mesh construction to model formulation and data analysis. The first part of the presentation will discuss these challenges in the context of a shift toward high-fidelity approaches such as Large-Eddy Simulation (LES). The second part of the talk will focus on simulations based on the Reynolds-Averaged Navier Stokes (RANS) equations, which also continue to play an important role in industry. In this framework turbulence modeling is a primary challenge, and a discussion of opportunities for model improvement will be presented for cases involving dispersion in urban-like geometries. The presentation will conclude with a brief overview of how these aspects could be integrated in a CFD course that will train future engineers to optimally leverage the capabilities of flow simulations.

Biosketch: David Philips is a Research Scientist at Cascade Technologies, a company that develops high-fidelity Large-Eddy Simulation (LES) software for applications ranging from turbulent combustion to aero-acoustics. At Cascade he performs simulations on national lab leadership class computing facilities and develops novel user-interface concepts that will transform the application of LES in industry. Prior to Cascade, David received undergraduate degrees from Dartmouth College and the Thayer School of Engineering in 2004 and 2005, respectively. He spent two years as a software consultant at an enterprise web application firm before entering graduate school in the Mechanical Engineering Department at Stanford University. David received his PhD in 2012 for thesis work that focused on applying Computational Fluid Dynamics to scalar dispersion in complex, urban-like geometries.

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