

Multiscale Modeling and Simulation of Advanced Power Generation Systems

Stephen E. Zitney, National Energy Technology Laboratory, Morgantown, WV 26507-0880

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ABSTRACT

The National Energy Technology Laboratory (NETL) is developing an Advanced Process Engineering Co-Simulator (APECS) for use in multiscale modeling and simulation of advanced power generation systems. The APECS integration framework enables design engineers to enhance the fidelity of system-scale process simulations by incorporating detailed equipment-scale models based on computational fluid dynamics (CFD). In this presentation we describe the APECS framework and capabilities, including use of advanced visualization, high-performance computing, and the process industry CAPE-OPEN software standard. We also highlight the application of APECS to a coal-fired, gasification-based power and hydrogen production plant for the U.S. Department of Energy's FutureGen project. Two high-fidelity CFD simulations, one for an entrained-flow gasifier and one for a gas turbine combustor, are coupled into the process simulation of a potential FutureGen plant configuration. The multiscale simulation results illustrate how the APECS system can help process engineers better understand and optimize the coupled fluid dynamics, heat and mass transfer, and chemical reactions that impact overall power plant performance and efficiency.