Seminar Announcement

"High Fidelity Simulations of Combustion at Extreme Conditions"

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Aula Magna

Dipartimento di Ingegneria

Host: Asst. Prof. Michele Battistoni

Abstract - The high pressure and turbulence intensity conditions encountered in modern combustion systems pose significant additional computational challenges in high fidelity simulations. Today's emerging high performance computing (HPC) hardware based on the hybrid CPU-GPU architecture with accelerators and many-core processors offers tremendous opportunities in large scale direct numerical simulations of reacting flows involving a large number of chemical species and reaction steps. These new architectures require legacy simulation codes to be rewritten and engineered to take full advantage of the hardware. The first part of the presentation provides and overview of a new development at KAUST for enhanced simulation capabilities. Performance results on GPU and MIC accelerators are compared for representative benchmark problems. Some recent simulations of turbulent premixed flames will also be presented and important characteristics of high Reynolds/Karlovitz number flames will be summarized. Finally, fundamental aspects on the auto-ignition of homogeneous mixtures with temperature fluctuations and various ignition regimes are discussed.

Biosketch - Hong G. Im received his B.S. and M.S. from Seoul National University, and Ph.D. from Princeton University. After postdoctoral researcher appointments at the Center for Turbulence Research, Stanford University, and at the Combustion Research Facility, Sandia National Laboratories, he held assistant/associate/full professor positions at the University of Michigan. He joined KAUST in 2013 as a Professor of Mechanical Engineering. He is a recipient of the NSF CAREER Award and SAE Ralph R. Teetor Educational Award, and is an Associate Fellow of AIAA and a Fellow of ASME. He has also served as an Associate Editor for the Proceedings of the Combustion Institute, and is currently on the Editorial Board for Journal of Combustion. Professor Im's research and teaching interests are primarily fundamental and practical aspects of combustion and power generation devices using high-fidelity computational modeling. Recent research topics include direct numerical simulation of turbulent combustion at extreme conditions, bluff-body flame stabilization mechanism, modeling of low grade and alternative fuels, spray and combustion modeling in advanced internal combustion engines, advanced models for turbulent sooting flames, electrical field effects on flames, and combustion characteristics of high hydrogen content fuels for advanced gas turbine applications.

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The ***Clean Combustion Research Center (CCRC)*** *at KAUST pursues leading solutions to global challenges arising from the combustion of fossil fuels, such as pollutant control, global warming and climate change abatement, and sustainable fuel usage.*