Combustion and Engine Research Using High Performance Computing

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Abstract
The Clean Combustion Research Center (CCRC) at King Abdullah University of Science and Technology (KAUST) has rapidly grown into one of the leading groups in combustion and engine research. The presentation will start with an overview of the cutting edge research activities and state-of-the-art facilities at KAUST CCRC. Subsequent technical presentation will highlight ongoing computational research activities at different physical scales, ranging from fundamental direct numerical simulations (DNS) for canonical configurations, large eddy simulations (LES) of laboratory scale flames, and device-scale simulations of internal combustion engines. Technical scope to be covered include turbulent premixed flame at high Reynolds/Karlovitz numbers, bluff-body flame stabilization, effects of pressure on turbulent jet flames, and pre-ignition/super-knock in modern engines.

Biosketch
Hong G. Im received his B.S. and M.S. in 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.