

Workshop for High-Performance Computing-Enabled Engine Simulations

Hosted by

The Virtual Engine Research Institute and Fuels Initiative (VERIFI)

Advanced Photon Source Conference Center, Argonne National Laboratory

November 12-13, 2014

Wednesday, November 12, 2014

7:30-8:30 am	Registration
8:00-9:00 am	<i>Coffee (APS Auditorium)</i>
9:15-9:30 am	Welcome to Argonne: Peter Littlewood, Director, Argonne National Laboratory
9:30-10:00 am	Keynote: Dr. Lou Balmer-Millar, Director of Research and Advanced Engineering, Caterpillar, Inc. Product Development: Keys for Success
10:00-10:30 am	Gurpreet Singh, U.S. Department of Energy DOE Perspective - the Need for High Performance Computing in Engine Simulation
10:30-10:45 am	<i>Coffee Break (APS Auditorium)</i>
10:45-11:00 am	Sibendu Som, Argonne National Laboratory Workshop Objectives and Mechanics
11:00-11:30 am	John Deur: Director of Combustion Research, Cummins Inc. High Performance Computing and Combustion System Design at Cummins
11:30-12:00 am	Ron Grover: Senior Research Engineer at GM R&D Diagnostics and Simulation of Sprays for Automotive Applications
12:00 am-12:30 pm	Jin Yan: Manager, Computational Combustion Lab, GE Global Research Center LES Modeling of In-cylinder Engine Performance
12:30-1:45 pm	<i>Lunch (APS Gallery)</i>
1:45-2:15 pm	Peter K. Senecal: Vice President and Co-owner, Convergent Science Inc. The Importance of High Performance Computing from a Software Vendor's Perspective
2:15-2:45 pm	Keven Hofstetter: Engineering Technical Steward for Machine Simulation, Caterpillar Inc. Product Development Excellence through Modeling & Simulation

- 2:45-3:15 pm Rishikesh Venugopal: Senior Staff Engineer, Achates Power
Advanced CFD for the Modeling and Optimization of Opposed Piston Combustion Systems
- 3:15-3:45 pm Marcus Hermann: Associate Professor, University of Arizona
High Fidelity Simulations of Liquid Fuel Atomization in Internal Combustion Engines and Complex Gas Turbine Injectors
- 3:45-4:15 pm Yuri Wright: Senior Researcher, ETH Zurich
Model free flow simulations in engine-like geometries – the role of HPC towards improved understanding of cycle-to-cycle variations
- 4:15-4:30 pm *Coffee break (APS Auditorium)*
- 4:30-5:00 pm Sibendu Som, Argonne National Laboratory
HPC Enabling a Paradigm Shift in IC Engine CFD
- 5:00-5:30 pm Ray Bair & David Martin, Argonne National Laboratory
Leveraging Argonne Computing Facilities and Expertise for Industry Challenges
- 5:30-6:00 pm Doug Longman & Steve Pratt, Argonne National Laboratory
Integrating Fundamental and Applied Combustion Research
- 6:15-7:00 pm *Reception (Guest House Dining Room)*
- 7:00-8:00 pm *Dinner (Guest House Dining Room)*
- 7:30-8:30 pm Speaker, Dr. Marius Stan, Sr. Computational Energy Scientist, Argonne National Laboratory
Science and Cinema

Thursday, November 13, 2014

- 8:00-9:00 am *Breakfast buffet available at the Guest House (on your own)*
- 9:15-11:45 am **Three tours for everyone (buses leave from the Guest House)**
 - Engine facilities and RCM
 - APS
 - ALCF and visualization lab
- Noon-1:30 pm *Lunch (Guest House)*
- 12:30-1:15 pm Speaker, Diane Hart, Manager, Sponsored Research Office, Argonne National Laboratory
Working with Argonne

1:30-5:30 pm

Two parallel sessions at Bldg. 240 (buses leave from the Guest House)

- “Hands-on” (Room 1404/1405)
- “One-on-One”

Tour Descriptions

Engine Facilities and RCM

Argonne’s engine testing capability spans from light duty to heavy duty, with engine’s ranging in size from 0.5L up to 19L. The facilities are equipped with state-of-the-art instrumentation for in-cylinder visualization, regulated and un-regulated emissions characterization (gaseous and particulate). These experiments generate high-quality data for validation of VERIFI simulations. Argonne is also the only National Lab with a rapid-compression machine for generating very controlled, engine-like conditions for studying fuel ignition and combustion properties.

APS

The Advanced Photon Source (APS) is a user facility at Argonne which produces the brightest x-ray beams in the western hemisphere and is dedicated to multi-disciplinary to advance science. A dedicated hutch at APS allows VERIFI researchers to gain fundamental understanding of fuel injection and spray phenomena (such as cavitation and jet interactions) and aid advanced model developments.

ALCF

The Argonne Leadership Computing Facility is a user facility at Argonne that provides the computational science community with a world-class computing capability dedicated to breakthrough science and engineering. The tour will include a visit to Argonne’s 10PetaFlop MIRA super-computer. VERIFI team uses these facilities and collaborates extensively with ALCF scientists to scale-up engine calculations.

Parallel Sessions

“Hands-on” Session

VERIFI researchers will guide the participants on how to login to a BlueGene machine and set-up engine simulations. The participants will run simulations on 1000s of processors and realize the benefits of HPC tools for engine simulations. Tips on how to scale up engine problems on massively parallel architecture will be discussed.

“One-on-One” Session

VERIFI experts will be available for discussions with industry representatives to understand their computing needs and provide guidance on how VERIFI projects could help them design and optimize the next-generation engines and fuels.