NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE

PAP Seminar Announcement

Remarkable simplicity out of complexity: role of the 2nd law of thermodynamics in kinetic models for complex systems

By

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Host: Asst Prof Marco Battiato

Abstract

Kinetic models were developed to describe the complex systems. They include the Boltzmann, quantum Boltzmann, Boltzmann-Curtiss, generalized Boltzmann, Vlasov-Landau, Balescu-Lenard, and Fokker-Planck equations. The applications of these complicated mathematical models are indeed diverse: molecular motion in gases and liquids, electron transport in semiconductors, viscoelastic fluids, granular flows, multi-phase flows, soft matter, biological system, and non-physical systems like stock market.

Nonetheless, there is a remarkable simplicity; all those models share microscopic interactions among particles and their interplay with the kinematic motion of particles in the macroscopic framework, and the closure problem to close the open high-order hierarchical systems. In the case of closure problem, the 2nd law of thermodynamics is supposed to play a key role.

This talk will review various approaches developed in the past to solve these problems and then present a recent approach based on the closing-last 2nd-order closure theory and its implementation to the practical multi-dimensional rarefied and microscale gas flows within the framework of the 2nd-order nonlinear coupled constitutive relations (NCCR) and the mixed-type modal discontinuous Galerkin method.

Short Biography

- Professor, Department of Aerospace and Software Engineering, Gyeongsang National University, Jinju, South Korea (1999-Present, http://acml.gnu.ac.kr/)
- Director, (Engineering) Research Center for Aircraft Core Technology, Jinju, South Korea (2017-Present, http://actrc.gnu.ac.kr/)
- Chairman, 32nd International Symposium on Rarefied Gas Dynamics on July 13-17, 2020 in Seoul, South Korea
- Research Associate, NASA Goddard Space Flight Center, US (1997-1999)
- Ph.D. in Aerospace Engineering, University of Michigan, US (1996)
- M.S. & B.S. in Aeronautical Engineering, Seoul National University, South Korea (1989, 1987)