Journal of Fluids Engineering

Guest Editorial

Special Issue on Fluids Engineering Research in Honor of the Life and Achievements of Professor Kirti Ghia—A Pioneer in Computational Fluid Dynamics

Professor Kirti "Karman" Ghia was an aerospace engineering educator, a research scientist, and a pioneer in the field of Computational Fluid Dynamics (CFD). He passed away on June 13, 2017, at the age of 80. He completed his M.S. and Ph.D. degrees in Mechanical and Aerospace Engineering at the Illinois Institute of Technology. For 47 years he was a faculty member of Aerospace Engineering and Engineering Mechanics at the University of Cincinnati (UC), where he founded the Computational Fluid Dynamics Research Laboratory. His pioneering CFD research has provided fundamental solutions for three basic incompressible flow problems: the driven-cavity, the curved-square cross section duct exhibiting Dean's instability, and the backstep geometry. These have served as benchmark solutions for numerous subsequent incompressible flow code developers. His separated-flow work on two-dimensional pitching airfoils led to unmasking the mechanism for a dynamic stall, and a key result from this work was published in the *Smithsonian*. His co-authored editorial statement on numerical uncertainty became the cornerstone of ASME's policy on numerical uncertainty, and AIAA's current statement has been drafted around that policy. Professor Ghia was very involved with both ASME and AIAA. For the latter, he served as a faculty advisor to the AIAA UC student branch, a member of the AIAA Fluid Dynamics Technical Committee, and an Associate Editor of the *AIAA Journal*. In ASME, he was very active in the Fluids Engineering Division and served as Chair of the Computational Fluid Dynamics Technical Committee and the Honors and Awards Committee, among several others.

This special issue is one of several activities that were initiated by the ASME Fluids Engineering Division and the ASME *Journal of Fluids Engineering* to honor the life and legacy of Professor Ghia. The issue consists of 14 invited and contributed papers by researchers who knew Professor Ghia or who worked closely with him either on his research or the myriad of professional activities that he was involved with in ASME and AIAA. The papers in this issue span a wide range of topics in fluids engineering and fluid mechanics. The paper by Shobayo and Walters addresses scale-resolving simulations of a statistically targeted forcing method for synthetic turbulence generation in freestream turbulence. The paper by Rajendran, Manglik, and Jog presents a new property averaging scheme for the Volume of Fluid Method for two-phase flows with large viscosity ratios. The paper by Kalajahi, Perez-Raya, and D'Souza estimates model parameters in permeable porous media flows using a deep neural net inverse modeling method. The paper by Banerjee, Selamet, and Dehner estimates turbulent length scales at a turbocharger inlet using stereoscopic particle image velocimetry. The paper by Dutta, Chattopadhyay, and Nandi deals with the modeling of turbulent flow through a 90 deg pipe bend using an unsteady Reynolds-averaged Navier–Stokes (U-RANS) approach where a k–ε model is used for turbulence closure. The paper by Wang, Z. Sun, Y. Sun, Zhang, and Xi presents a three-dimensional full-scale centrifugal pump simulation using a moving particle semi-implicit (MPS) method. A generic smoothed wall (GSW) boundary is used and extended to three dimensions to address complicated wall shapes and thin-walled structures such as blades in turbomachines. The paper by Altland, Xu, Yang, and Kunz employs RANS simulations on six different packing densities of cubes in aligned and staggered configurations. The packing densities investigated span from what would classically be defined as isolated, up to those in the d-type roughness regime. A second paper by Shobayo and Walters discusses synthetic turbulence generation by a proposed statistically targeted forcing (STF) method. The new method seeks to introduce a fluctuating velocity field with distributions of first and second moments that approximate a user-specified target mean velocity and Reynolds stress tensor, by incorporating deterministic time-dependent forcing terms into the momentum equation for the resolved flow. The paper by Kamin and Khare presents results of a numerical investigation to systematically evaluate the effects of the aerodynamic Weber number, in the range from 68 to 136, on spray characteristics and gaseous fluid dynamics when liquid jets are injected in high-temperature air crossflow. The paper by Kaul discusses an active flow control approach for a spatially growing mixing layer. The paper by Botros, Clavelle, and Satish presents experimental results of the normalized pulsation pressure amplitudes versus the Strouhal number to characterize the flow-acoustic field for acoustically tuned and detuned systems and for a branch-to-main pipe diameter ratio of 1. The paper by Shad and Sherif presents an approach to numerically simulate the inherently unsteady rime ice accretion problem on a two-dimensional airfoil and elucidate the associated variations under different icing conditions. The paper by Palakurti, Ghia, and Turkevich presents a numerical investigation of aerosolization in a Venturi dustiness tester for investigating the aerodynamics of a particle on a hill. Finally, the paper by Mikhail who is a former Ph.D. student of Professor Ghia reviews six legacy cases that he and Professor Ghia investigated. Three of the six cases are in the applied missile and projectile fluid dynamics (aerodynamics) and three are for projectile CFD.

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