SEMINAR

MULTIPHASE LARGE-EDDY SIMULATIONS OF HUMAN COUGH JET DEVELOPMENT AND EXPIRATORY DROPLET DISPERSION

Speaker

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Abstract

Coronavirus disease 2019 (COVID-19) is a contagious disease caused by infection of the SARS-CoV-2 virus, which can lead to deadly severe acute respiratory syndrome. Since late 2019, COVID-19 has rapidly spread worldwide and caused the current global pandemic. The main route of transition of the SARS-CoV-2 virus is through the virion-contained droplet and aerosol dispersion and transmission, which come from the exhaled airflow of cough jets from sneezing and coughing of the virus carriers. In this talk, I shall present a systematic modeling study on the in-door airflow characteristics of human cough jets by using large-scale multi-phase fluid dynamics modeling and large eddy Smoothed Particle Hydrodynamics (SPH) simulations. In the past two years, we have conducted large-scale (>200 million particles) multiphase SPH turbulence flow calculations to simulate the real size and real-time human cough jet development and expiratory droplet dispersion and aerosol formation process, providing the fundamental physical details on the spatial and temporal evolution of human cough jets, shedding the light on social distance policy and prevention measures on future infectious respiratory diseases. In particular, we have studied the effects of two-way coupling, i.e., the coupling between air and droplets, on turbulence structure and duration of the cough jet.

Biography

Dr. Shaofan Li is currently a full professor of applied and computational mechanics at the University of California-Berkeley. Dr. Li graduated from the Department of Mechanical Engineering at the East China University of Science and Technology (Shanghai, China) with a Bachelor of Science (B.S.) degree in 1982; he also holds a Master of Science (M.S.) degree in Applied Mechanics (the Huazhong University of Science and Technology, Wuhan, China) and in Aerospace Engineering (the University of Florida (Gainesville, FL, USA) in 1989 and 1993, respectively. In 1997, Dr. Li received a Ph.D. degree in Mechanical Engineering from Northwestern University (Evanston, IL, USA), and he was also a post-doctoral researcher at Northwestern University during 1997-2000. In 2000, Dr. Li joined the faculty of the Department of Civil and Environmental Engineering at the University of California-Berkeley. Dr. Shaofan Li is the recipient of the Fellow Award of the International Association of Computational Mechanics, the USACM Fellow Award (2013), and the NSF Career Award (2003). Dr. Li has published more than two hundred fifty technical papers in peer-reviewed scientific journals with an h-index of 57 (Google Scholar), and he also co-authored three research monographs/graduate textbooks.

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