VIDEO ARTICLE

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Aerosols Transport, Dispersion and Deposition-Applications to Transmission of COVID-19

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Abstract

Applications of particle transport, deposition, and removal in Industrial, environmental and biological flows are presented. Attention was given to the mechanics of particulate transport, dispersion, and deposition in turbulent flows. Numerical simulations of airflow with the use of the Reynolds averaged Navier-Stokes (RANS) equation, as well as DNS and LES, are described. The stochastic models for simulation of instantaneous fluctuation velocity are also discussed. The Lagrangian particle trajectory analysis method is presented, and the effects of various forces, including drag, lift, gravity, and Brownian, are described. The dispersion and deposition of airborne particles in turbulent flows are analyzed. Examples of computational modeling of gas-solid flows in ducts and pollutant transport in indoor and outdoor environments are presented. Particular attention is given to the applications to the transmission of the SARS-CoV-2 virus are also presented. It is shown that computational modeling provides an efficient tool for studying gas-solid flows in complex passages and spreading virus-laden droplets in connection with COVID-19.

Biography of Presenting Author

PROFESSIONAL PREPARATION

- Purdue University, West Lafayette, IN Civil Engineering M.S. 1968

- Purdue University, West Lafayette, IN Mechanical Engineering Ph.D. 1970

APPOINTMENTS

2005-2015	Dean, Coulter School of Engineering, Clarkson University
2004-2005	Associate Dean for Research and Graduate Programs, Coulter School of Engineering, Clarkson University
2004-2005	Interim Vice Provost for Research, Clarkson University
2003-Present	Robert R. Hill '48 Professor, Department of Mechanical and Aeronautical Engineering, Clarkson University
2001-Present	Clarkson Distinguished Professor, Department of Mechanical and Aeronautical Engineering, Clarkson University
1991-1994	Chairman, Department of Mechanical and Aeronautical Engineering, Clarkson University
1981-Present	Professor of Mechanical and Aeronautical Engineering, Clarkson University

SYNERGISTIC ACTIVITIES

- Developed and taught courses on Intermediate Fluid Mechanics, Particle Transport, Deposition and Removal, Aerosol Mechanics, Stochastic Processes in Engineering, Advance Theory of Turbulence, Multiphase Flow Modeling, Particle Transport, Deposition and Removal, Vibrations, Advanced Vibrations.
- Developed an efficient computational model for Brownian diffusion of particles in laminar and turbulent flows. The method is now being used in ANSYS-FLUENT commercial code.
- Contributed to the development of practical methods for dilute two-phase flow analysis. The approach is being used to improve the operation and design of engineering systems in several companies.
- Four patents (US Patents 6,530,823 B1, 2003; 6,543,462 B1, 2003; 6,719,613, 2004; 6,945,853 B2, (2005)
- J. Y. Tu, K. Inthavong, and G. Ahmadi, “Computational Fluid and Particle Dynamics in the Human Respiratory System,” Springer, New York (2013). ISBN 978-94-007-4487-5.
- **Conference Papers and Presentations: 1250**, **Invited Talks: 190**

HONORS AND AWARDS

- Fellow, American Society of Mechanical Engineers, ASME (1997)
- Lifetime Research Achievement Award, Clarkson University (2015)
- Fluid Engineering 90th Anniversary Medal, ASME (2016)
- ASME Freeman Scholar Award, ASME (2016)
- Fellow, American Society of Thermal and Fluid Engineers, ASTFE, (2019)

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