Mechanical Engineering
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224 MEC

"Problems in Interfacial Electrohydrodynamics"

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ABSTRACT

Recent microfluidic applications involve the study and control of systems that contain immiscible fluids which are separated by free interfaces. It has been found that electric fields acting on the micro-scale, can significantly affect the stability of the flow producing phenomena such as interfacial turbulence (even at zero Reynolds numbers), and topological transitions such as droplet formation in microchannels. This talk will review some of the pertinent applications involving interfacial electrohydrodynamics - some experiments performed at NJIT will also be described. Next, I will present the mathematical models for a simplified geometry and show what can be done theoretically before recourse to direct simulations. Finally, time permitting, I will show some preliminary results from ongoing direct simulations.

BIOGRAPHY

Demetrius T. Papageorgious is presently a Professor of Mathematical Sciences at NJIT. He received his Mathematics Ph.D. from Imperial College, University of London and his BSc from University College, University of London. He has received honors and awards that include the Fellow of the IMA (Institute of Mathematics and its Applications), in 2002 he received the Harlan Perlis Award for Research from NJIT and in 1993 he received the National Aeronautics and Space Administration Group Achievement Award, ICASE Fluid Mechanics Group from the Langley Research Center. Professor Papageorgious is the Co-Editor in-Chief of IMA Journal of Applied Mathematics and the Associate Editor of SIAM Journal on Applied Mathematics and is in the Editorial Board of Computational and Applied Mathematics. His research focuses on the modeling, analysis, and computation of physical and technological problems that involve fluid dynamics and aerodynamics. His studies in surface tension driven flows cover the stability, dynamics, and breakup of single and compound liquid jets, both in the presence and absence of surface active agents, which affect interfacial tension. Analysis of finite-time-singularities has been used to motivate experiments for rheological measurements. His studies in bubble dynamics are a theoretical and experimental collaborative research effort to control the drag on rising bubbles using surfactants. Current projects include jet and bubble dynamics, nonlinear stability of core-annular flows when surfactants are present, nonlinear stability of electrified liquid films, and study of viscous flows in pulsating channels or tubes by construction of Navier-Stokes solutions both numerically and analytically with particular emphasis on chaotic regimes and their influence on applications.

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