ME Seminar

Multiscale Experimental and Numerical Investigations in Multiphase Flows: From Fundamental Studies to Biomechanical Applications

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ABSTRACT

In this seminar, I will begin with a brief overview of my research portfolio spanning experimental fluid mechanics, biofluid dynamics, and multiphase transport. I will then focus on my recent work at KTH Royal Institute of Technology, Sweden, on flow characterization during venous needling in arteriovenous fistulas for hemodialysis. Using planar laser-induced fluorescence (PLIF) and particle image velocimetry (PIV), complementary laser-based flow diagnostics, I will present the scalar mixing and velocity fields downstream of venous needle in patient-relevant geometries. The primary and secondary flow structures identified in these measurements have direct implications for vascular access outcomes and dialysis efficiency.

Following this, I will briefly discuss my earlier work on sessile drop evaporation, where I observed a unified correlation connecting three key aspects of evaporation: contact-line dynamics, thermal field at the liquid-vapor interface, and internal flow patterns. I will also outline numerical simulations performed on surfactant adsorption at solid–liquid interfaces, a process central to understanding wetting behavior in applications such as inkjet printing.

The seminar will conclude with an outline of my future research plans integrating high-fidelity experiments and modeling for clinically and industrially relevant flows, along with a brief discussion of my teaching interests.

ABOUT THE SPEAKER

Dr. Tejaswi Josyula is a Postdoctoral Researcher at KTH Royal Institute of Technology, Sweden, working in the area of experimental fluid mechanics with applications in artificial medical devices and therapeutic flows. His current research focuses on hemodynamics during hemodialysis, with an emphasis on understanding downstream flow from venous needles in arteriovenous fistulas. He received his PhD in Mechanical Engineering from the Indian Institute of Technology Madras, where he investigated sessile drop evaporation using optical imaging, infrared thermography, and particle image velocimetry. Following his doctoral work, he was a Postdoctoral Researcher at the Technical University of Darmstadt, Germany, where he studied wetting and transport processes in impinging surfactant-laden drops through high-fidelity numerical simulations. His broader research interests lie in combining advanced experimental laser diagnostics and numerical modeling to study multiphase transport phenomena and clinically relevant biofluid flows.

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