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ADVANCED MODELING AND APPLICATIONS IN MICROFLUIDICS

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ABSTRACT

Microfluidics plays a pivotal role in advancing modern science and engineering by enabling precise manipulation and control of fluids at the sub-millimeter scale. The inherent complexity of these systems—often involving multiphysics interactions, complex rheology, and fluid-structure interaction (FSI)—demands robust analytical and computational approaches that extend beyond traditional fluid dynamics. We welcome contributions that utilize a wide spectrum of computational techniques to solve complex micro-scale challenges.

The session will highlight how state-of-the-art models, when coupled with empirical observations, can accelerate the predictive design, optimization, and practical application of microfluidic technologies. Submissions are encouraged in, but not restricted to, the following key areas:

- **Biotechnology:** Advanced modeling of mechanobiology, simulating cellular responses to fluid shear stress, and optimizing fluidic environments for tissue engineering.

- **Medicine and Drugs:** The computational and experimental development of lab-on-a-chip and organ-on-a-chip models, targeted drug delivery systems, and innovative diagnostic tools.

- **Devices:** The design, optimization, and performance analysis of micro-devices, encompassing soft microfluidic sensors, elastomeric micro-valves, active sorters, and micromixers.

- **Physics and Chemistry:** The fundamental study of multiphase micro-flows, electrokinetic phenomena, transport of complex fluids, and coupled heat and mass transfer at the microscale.