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Mechanics Research Communications and the Granular Science Laboratory

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New Jersey Institute of Technology

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11:30 a.m. – 1:00 p.m.
ME Center: Room 224

Controlling Particles in Microfluidic Channels

We have been studying the manipulation of particles in both uniform and non-uniform electric fields in microfluidic devices, using experimental and numerical tools. In a uniform field, particles experience chaining under particle-particle interactions. In a non-uniform electric field, the particles of a suspension experience both dielectrophoretic (DEP) and electrostatic particle-particle forces. In applications which require that the particles be manipulated individually, e.g., size separation of DNA molecules, the latter forces are not desirable since they induce particle chaining. On the other hand, such forces are crucial in applications where the particles must touch, e.g., electrofusion of biological cells, nanocircuit fabrication and electrorheological suspensions of increased viscosity. By using numerical simulations to compute electrostatic forces, we show how the ratio of the particle-particle and DEP forces varies with the particle size, the gap between the particles, and the Clausius-Mossotti factor. In AC dielectrophoresis, the particle chain formation can be controlled by operating in particular frequency regimes. Experiments in a micro fluidic device have been performed, illustrating the various regimes.

Professor Aubry is Distinguished Professor and the F. Leslie and Mildred Jacobus Chair in the department of Mechanical Engineering at NJIT, and Director of the New Jersey Center for Micro-Flow Control. She joined NJIT in 1996 as the Jacobus Professor of ME and since 1997 has held a joint appointment in the Mathematical Sciences department. Prior to this, she was a Professor at the City College of CUNY. She received her Ph.D. degree from Cornell University. Professor Aubry's research is in the area of fluid dynamics. She is well-known for her pioneering work on the modeling of turbulence via dynamical systems theory, and recently has focused her efforts on challenging problems in the field of micro fluid dynamics. Her many awards and appointments include the National Science Foundation Presidential Young Investigator Award, Fellow of the American Physical Society and appointment as vice chair of the U.S. National Committee on Theoretical and Applied Mechanics, the National Research Council Committee which represents the U.S. National Academy of Science in the field of mechanics internationally, and serves as the sole national forum for defining major issues in mechanics research, technology, and education.

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