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Transport of densities in position-orientation space for the study of orientable particles in microchannels THOMAS JOHN, IGOR MEZIC, UCSB — We consider the dynamics of orientable particles in low Reynolds number flows. We use Langrangian methods to analyze transport of densities in the extended phase space that we have shown is appropriate for the analysis of reaction between these oriented particles. We prove the equivalence of the advection equation in the extended space with the infinitesimal generator of the semi-group of Perron-Frobenius operators associated with the dynamics of the particles and use this equivalence to compute the density at downstream locations in micro-devices given the inlet densities. In the case that includes diffusion, we develop an efficient backward Monte Carlo method to study the transport of density. We compare with the PDE solution and show that in cases where the solution is desired on a lower dimensional subset of the domain, substantial gains can be made by these methods. We apply the method to the study of a shear superposition micro-mixer.

Thomas John
UCSB

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