MMAE SEMINAR

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Abstract

Fully resolved simulation of particulate flows: From macro to sub-micron scales

A formulation will be presented for fully resolved numerical simulation of freely moving rigid particles in fluids. The idea is to assume that the entire fluid-particle domain is a 'fluid' and then to constrain the particle domain to move with a rigid motion. It is suitable for fast computations and can be employed for turbulent flows. We have also shown that the same approach can be successfully applied to the fully resolved simulation of Brownian particles. In our Brownian motion technique, named Fluctuating Immersed MATerial (FIMAT) dynamics, the thermal fluctuations are included in the fluid equations via random stress terms. The random stress in the fluid equation is easy to compute unlike the random terms in the conventional Brownian/Stokesian dynamics type approaches. FIMAT finds application in variety of bio-mechanics problems. Thus, we provide a framework for fully resolved simulation of particulate flows that range from macroscale turbulent flow systems to mesoscale Brownian systems. The same methodology is now being extended to develop algorithms to simulate freely swimming fish dynamics; some preliminary results of which will be presented.