New Techniques for the Simulation of Microanalytical Instrumentation

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The presentation starts by reviewing new simulation techniques that have recently been extended for use in the area of micro electro mechanical systems (MEMS) [1]. This includes Dissipative Particle Dynamics (DPD) and the Lattice Boltzmann Method (LBM) for microfluidic applications [2], topology optimization for compliant and fluidic microstructures [3] and model reduction (MOR) as a bridge between device and system level simulation [4][5]. These techniques allow for a new level of computer aided support during the design of microanalytical instrumentation, and in some cases for a complete breakthrough in predictive power. After that, we analyze simulation tool requirements from the viewpoint of a variety of microanalytical instruments. We match available methods to the requirements, identify potential gaps in capabilities and speculate on how to bridge them. A case study for a Micro Ion Mobility Spectrometer rounds off the presentation.

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