

Abstract:

We are developing a simulation framework for paper making, focusing on two topics: simulation of paper forming, and simulation of the properties of the resulting virtual sheets. To simulate paper forming, we model the fibers as beams and the fluid is governed by the Navier-Stokes equations. A novel method for calculating the fiber-fiber interaction, based on DLVO forces, has been developed. Lay down simulations are performed with thousands of fibers flowing down onto an industrial forming fabric. Moreover, with virtual paper sheets at hand, we model the sheets as fiber networks to enable simulation of the mechanical properties. We have developed a numerical multiscale method for unstructured discrete networks by extending and modifying the LOD (localized orthogonal decomposition) method. The fiber network is represented by a low-dimensional solution space whose basis functions are modified by solving localized subproblems. The new modified low-dimensional space has good approximation properties for unstructured networks with highly varying coefficients, showing optimal order convergence rate. In this talk, an overview of this work is presented.