Biopolymer Networks: Simulations of Rigid Rods Connected by Wormlike Chains

KNUT M. HEIDEMANN, Department for Numerical and Applied Mathematics, Georg August University Goettingen, MEENAKSHI M. PRABHUNE, FLORIAN REHFELDT, Third Institute of Physics - Biophysics, Georg August University Goettingen, MAX WARDETZKY, Department for Numerical and Applied Mathematics, Georg August University Goettingen, CHRISTOPH F. SCHMIDT, Third Institute of Physics - Biophysics, Georg August University Goettingen, SFB 755 NANOSCALE PHOTONIC IMAGING: HIGH-RESOLUTION STRESS-FIELD MAPPING IN FIBER NETWORKS AND CELLS COLLABORATION — The cytoskeleton of cells is a composite network of filaments ranging from stiff rod-like microtubules to semiflexible actin filaments that together play a crucial role in cell structure and mechanics. The collective dynamics of these cytoskeletal filaments with different mechanical properties are yet to be understood completely. To model such a strongly heterogeneous composite, we simulate networks of rigid rods connected by flexible linkers (wormlike chains). We extract elastic moduli by quasistatic deformations at varying filament densities and analyze the crossover between cross-link dominated and rod dominated regimes. In particular, we are interested in the asymptotic stress dependence of the differential modulus. The simulations are accompanied by rheological experiments on networks of microtubules (MTs) cross-linked by double-stranded DNA of variable length (cf. talk Meenakshi Prabhune).

Knut Heidemann
Department for Numerical and Applied Mathematics,
Georg August University Goettingen