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Soft Matter in Motion

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Abstract

The dynamics of soft matter combines the fields of non-equilibrium thermodynamics, elasticity theory and hydrodynamics. Theoretical approaches thus combine molecular simulations, continuum modeling and scaling approaches.
This is demonstrated with a few examples:
-Spider silk consists of polypeptides with highly repetitive motives and readily absorbs on hydrophilic surfaces. Single molecule AFM studies yield adsorbtion energies and point to an extremely high mobility on hydrophobic surfaces. Atomistic MD simulations show that binding and high mobility are related to the interfacial water structure at hydrophobic surfaces.
-Shear-flow induced unfolding of proteins plays an important role in starting the coagulation cascade in small blood vessels. In the theoretical modeling the unfolding is initiated by single-chain protrusion-like excitations and leads to a hdrodynamic unfolding transition, with is well captured by a scaling nucleation.
-Bacteria have developed propulsion mechanisms well adapted to the low-Reynolds number enviroment in a celll. The helical flagella of Salmonella and E. Choli are well known. Here we characterize the motion of Spiroplasma, a very small and primitive bacterium that has a helical between right and left handed helicity down ist body.