Brownian dynamics simulation for electrophoresis of single DNA molecule in polymer solution

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Brownian dynamics simulation is performed to study electrophoretic motion of a single DNA molecule in polymer solution. We use the bead-spring model for DNA molecule. In the model beads are affected by both hydrodynamic and spring forces. The worm-like chain model is used to describe the spring force. Dynamics of a single molecule in either extension or shear flow is well investigated. However, the bead-spring models used in those studies are based on the assumption that intermolecular interactions are negligible. When a DNA molecule is forced to pass through pores in polymer solution by electric field, it is influenced strongly by surrounding polymer molecules. Although numerous experiments have been carried out for manipulating DNA in polymer solution, theoretical analysis for the dynamics of DNA affected by external electric filed is lacking. Brownian dynamics results are in good agreement with experiments and furnish better understanding for the dynamics of DNA in polymer solution.