ELECTRO-HYDRODYNAMIC EFFECT ON DNA DYNAMICS DURING TRANSPORT

Sookkyung LIM [1], Yongsam KIM [2] and David SWIGON[3]

1) *Department of Mathematical Sciences, University of Cincinnati, Cincinnati, OH, USA*
2) *Department of Mathematics, Chung-Ang University, Seoul, KOREA*
3) *Department of Mathematics, University of Pittsburgh, Pittsburgh, PA, USA*

Corresponding Author: Sookkyung LIM, e-mail@sookkyung.lim@uc.edu

ABSTRACT

We present computer simulations of DNA dynamics in electric field motivated by the experiments of Tang et al. [1] in which individual T4 DNA molecules were compressed into a compact form due to moderate electric field. Our simulations also show that DNA molecule in a fluid in the presence of counterions and electric field has a tendency to undergo compression. The amount of compression depends on the ionic strength and the electric field intensity. We have developed a stochastic version of the generalized immersed boundary method [2, 3] and applied this method to simulate the dynamics of a circular DNA with bend and twist together with electrostatic force and thermal force.

REFERENCES

[1] J. Tang, N. Du, and P.S. Doyle, Compression and self-entanglement of single DNA molecules under uniform electric field. *Proc Natl. Acad. Sci. USA*, Vol. **108**, pp. 16153 – 16158, 2011.

[2] S. Lim, A. Ferent, X.S. Wang, and C.S. Peskin, Dynamics of a closed rod with twist and bend in fluid. *SIAM J. Sci. Comput*., Vol. **31**, pp. 273-302, 2008.

[3] P. Atzberger, P.R. Kramer, and C.S. Peskin, A stochastic immersed boundary method for fluid-structure dynamics at microscopic length scales. *J. Comp. Phys.*, Vol. **224**, pp. 1255-1292, 2007.