

Physics 480 and 581: Homework #4
Due December 5, 2011

1. (15 points)

Generate a 1D Freely Jointed Chain that is under a stretching force of 1 pN. Use 1000 segments, each of length $L_{seg} = 10$ nm. Repeat your calculation many times and compare $\langle z \rangle / L_{tot}$ to that expected from the theoretical force-extension curve for a 1D FJC. Submit your results as an annotated MATLAB m-file that can be run to generate the results.

Hints: Each link can only either go in the positive or negative direction. Use the Boltzmann distribution to find the probability of taking a step in the positive or negative direction. Use your found probabilities and the MATLAB function 'rand' to decide when to step positive or negative.

2. (581 only: 15 points) Generate a 3D Worm Like Chain that is under a stretching force. Use 10000 segments, each of length $L_{seg} = 1$ nm. Use a typical dsDNA persistence length of $A = 35$ nm. From your simulations, generate an 'observed' force-extension curve in the region of zero to 10 pN and compare it to the theoretical force-extension curve for a 3D WLC. Submit your results as an annotated MATLAB m-file that can be run to generate the results.