BM4040 Mechanobiology

Assignment 3

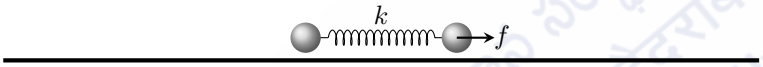
Deadline: March 22, 2024 **Total marks: 60**

Instructions

1. You have to write down the answers to each question clearly.
2. Submit the assignment in PDF format at this link.

Questions

1. Consider a very simple model of a cell represented by two rigid beads connected with a spring of spring constant k (see figure below).



The two beads can form ligand-receptor bonds with the surface (thick black line). Imagine that the cell has been kept on the surface so that bond formation has reached an equilibrium.

   (a) Assuming the system to be one-dimensional, what is the probability density of the lip bonds formed between each bead and the substrate? Write down the definition of all the parameters used in the description.

   (b) Once the cell has reached equilibrium, a constant force f is applied to one of the beads. If the radius of each bead is a and the viscosity of the medium is μ write down the equations describing the motion of the center of the cell.

   (c) Solve the equations obtained in (b) numerically.

   (d) Plot the steady state velocity of the center of the cell as a function of f.

2. Go through the research papers uploaded on the course webpage.