The Matlab file `runjump.m` runs a simulation of jumping, using the state-derivative functions `fjump.m` and `fjumpc0.m`. The simulation includes integration of the equations of motion for ground contact, along with computation of the aerial phase to determine the eventual maximum height and the distance of the jump. The program then produces contour plots of the maximum height and distance as a function of run-up speed and leg plant angle. The last portion of the program demonstrates how the same computations may be repeated for the system with a tendon with zero compliance (i.e., no tendon at all). Modify or use portions of `runjump.m` in order to answer the following questions.

1. The contour plot shows that the optimum long jump distance is achieved for a fast run-up and a relatively steep plant angle. If a long jumper is particularly slow, is the optimum plant angle reduced or increased?

2. The high jump simulation uses an initial knee angle of 170°. What is the effect of varying the knee angle on the maximal height? Is it necessary to change the run-up speed and plant angle to achieve this height?

3. The high jump simulation uses a maximum torque of $T_{\text{max}} = 2.5\ mg$\.. What is the effect of varying $T_{\text{max}}$ on the maximal height? Is it necessary to change the run-up speed and plant angle to achieve this height?

4. Vary the force-velocity curve parameter $G$ to answer the same questions as in problems 2 and 3. Plot the torque-angular velocity curve for a few values of $G$ and explain what its effect is on that curve.

5. The high jump simulation assumes that the initial vertical velocity is 0. In actual jumpers, there is a slight downward velocity of about $-0.2\ \sqrt{g}$\.. Does this downward velocity affect the optimum jumping strategy, or the maximal height?

6. Is it advantageous to have more or less tendon compliance, keeping other factors the same, to achieve the highest possible jump? How about the longest possible jump?

7. The parameters for this model were arrived at through educated guessing. Suppose that a Hill muscle model were used to set these parameters. Assuming that the normalized force-length and force-velocity curves are known, what muscle parameters are needed to perform the simulation with the Hill model?