

## 6.894 Legged Locomotion in Robots and Animals

Handout No. 07

October 12, 1999

### Problem Set 5

#### Problem 1

**1.1** Suppose a  $20\text{kg}$  kangaroo has a hopping height of  $1.5\text{m}$  and a hop to hop efficiency of  $70\%$ . During each hop suppose it stores the hop to hop energy in its achilles tendon. Calculate the amount of energy (in Joules) which the tendon must hold.

**1.2** Century Spring Corporation part number 672 is a pretty large spring which weighs  $12.8\text{oz}$ . It has a stiffness of  $194.13\frac{\text{lb}}{\text{in}}$  and a maximum deflection of  $0.96\text{in}$ . What is the maximum amount of energy (in Joules) that this spring can hold? Based on this Century Spring how much weight of spring would be needed to replace the kangaroo tendon?

#### Problem 2

Explain how springs can be used for Efficiency Amplification, Power Amplification, Endurance Amplification, or in a switch or latch mechanism. Make sure to be clear on what you mean by “efficiency”, “endurance”, etc. Give examples from nature and engineering of spring usage and describe how they fit in one or more of the above categories.

#### Problem 3

Think of a couple possible final class projects you might like to work on and briefly describe them. This is just exploratory. The project proposal itself will be due on October 26th.