ASSIGNMENT 3 — MUSCLE MODELLING

For all questions below, provide all programming code and plots in the report. (undergrads 19 marks | graduates 21 marks)

1. Plot the following (should look the same as in lecture). 5 marks (undergrad) | 7 marks (graduate)

   a. Activation Dynamics. 1 mark

   b. Active Force Length Curve. 1 mark

   c. Passive Force Length Curve. 1 mark

   d. Force (x-axis)-Velocity Curve. 1 mark

   e. Tendon Strain-Force Relationship. 1 mark

   f. Tendon Compliance — write equation and plot **(Graduates Only)**. 2 mark

   g. Note: You can also refer to Thelen (2003) for the equations, albeit with a slight change in some of the notation

2. Program the Hill-Model presented in Class. 10 marks

   a. Replicate the slide (10): Hill Models | Max Stim. Use the same initial conditions as listed on the slide. Plot STIM, γ, Tendon Force, Muscle Fiber Length, and Tendon Length. 10 marks

   b. Use any integration scheme you prefer, but you may have to go quite small with Euler (e.g., 0.00001 s)

3. Muscle questions to be independently answered (4 marks)

   a. Why are slow-twitch muscle fibers recruited first? 1 mark.

   b. What neural factors modulate the contraction intensity of muscle? 1 mark.

   c. What molecule provides energy for active transport and muscle contraction, and briefly describe how it works. 1 mark.

   d. Why is there a non-linear region in the tendon force-strain curve? 1 mark.