

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 — define equation (**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.