Exercise 2 PMR5005

Calculate the parameters of the Hill muscle model based on the experimental data presented below.

Given the details of the experiment are presented in the figure, it was proposed a model of the muscle (Hill´s model) based on springs, damper and an active element.

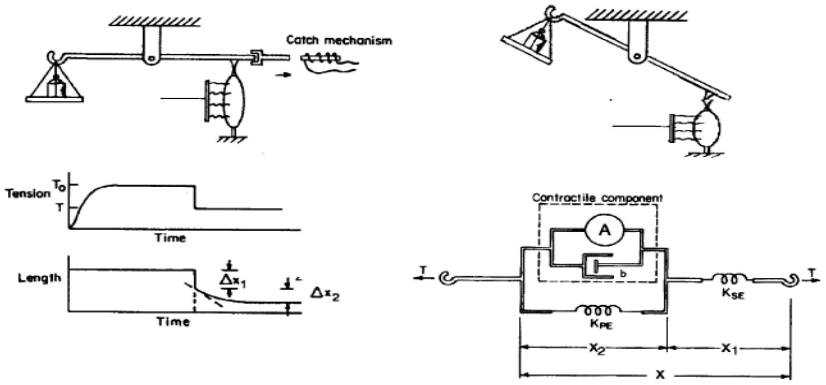

Figure 1. Experiments designed to determine the muscle force-displacement relationship (McMahon, 1984).

To determine the model parameters a pattern of electrical stimuli were applied to the muscle. First an isometric twitch was obtained, afterwards it was stimulated to reach the maximum contraction (tetanus[i]) during 2-3 s. During this period of tetanic contraction, it was applied a displacement to the muscle and the resultant force was recorded (see Figure 2). At the end of the displacement the tetanic stimulation was stopped, and it was induced another isometric twitch.

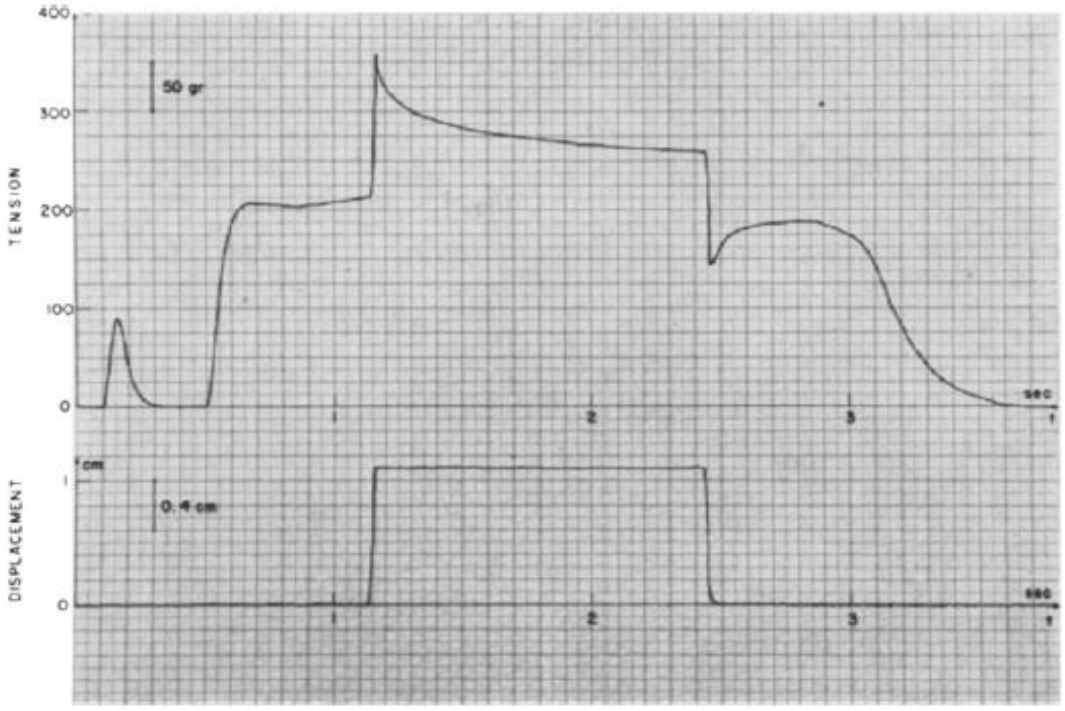

Figure 2. Force as a response to displacement of a muscle under tetanic contraction (Inbar and Adam, 1976).

References

McMahon TA (1984) Muscles, reflexes, and locomotion. Princeton University Press, Princeton NJ.

Inbar GF, Adam D (1976) Estimation of muscle active state. Biol. Cybern 23:61-72.

[i] Tetanus: Maximum muscle contraction. It occurs with the maximum stimulation of the motor unit. In this condition, the muscle force is constant.