# Sampled- Data Control Problems in the Isometric and Non-Isometric Force-Fatigue Model

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June 4, 2021

**Abstract**

In this joint work with Jérémy Rouot we present two models validated experimentlly due to Ding et al et Marion et al. respectively, and describing the muscular force response to electrical stimulations in the isometric case, and in the non isometric case where the force is producing a joint angle displacement. The problem can be set in the frame of optimal sampled-data control since in the model the electrical conduction which drives the Ca2+ concentration is a second-order dynamics control by the Dirac impulses related to electrical stimulations. The calcium concentration controls the force response using a non-linear dynamics related to Michaelis-Menten functions. The joint variable displacement is driven by the force response using a non-linear pendulum. The optimal control problems are presented in the isometric and non-isometric cases in relation to applications in the two cases, which can be either force strengthening or force tracking in relation with smart electrostimulator design or trajectory planning. We present the theoretical results related to this application in relation with the optimal sampled-data framework.