Formulations After Features Extraction of Veltink to Second-Order Critical Damped Black Box Model for Observer Formation Representing Knee Extension(Book Chapter)

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Abstract:
Real-world function electrical stimulation (FES) encounters nonlinear effects of fatigue and time delay that cause the FES controller to underperform and sometimes fail. Nonlinearities degrade the muscle performance and change the system, but the FES controller cannot be re-tuned once its parameters are set. System representation using an observer enables the patient's knee extension to be represented in a numerical computation algorithm and can be run or executed in an embedded system. This allows tuning of the closed-loop controller to be made to the imitated system. The formation of an observer requires parameters to be collected through feature extraction process. The transformation of these collected parameters to suitable parameters for the observer formation can be eased with the establishment of a control law made of equations and rules and finally represented in a look-up table. This paper investigates the feasibility of using the second-order system response to formulate controller setting and observer formation. MATLAB/Simulink software is used to study, and the simulation results are used to establish the formulation of the system for an observer formation representing the knee extension model.