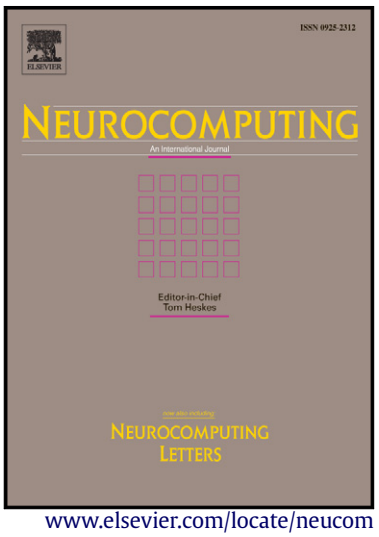

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S. Mefoued

Abstract

In this paper, we present an actuated orthosis aimed to assist the movements of dependent persons. The orthosis is controlled through the subject's intention, estimated by a Radial Basis Function Neural Network (RBFNN). The RBFNN takes into account the nonlinearities between the neural muscle excitation and the resulting knee joint position. This includes the modeling of the muscular activation dynamics, contraction dynamics as well as the dynamics modeling of the subject's lower limb- actuated orthosis system. The RBFNN is trained to give the desired movement by the subject, using the Electromyogram (EMG) signals measured on the quadriceps muscle. A Second order Sliding Mode Control (SoSMC) is developed and used to control the equivalent system "Shank-foot-orthosis". Stability of the proposed approach is demonstrated, in the closed loop, using the Lyapunov theory. Finally, experimental tests are conducted with five voluntary subjects in sitting position during flexion/extension of their knee joint. The obtained results have shown promising tracking results in term of tracking error, stability and robustness of the system against the co-contraction test.

Key words: Actuated Orthosis, EMG Signal, Radial Basis Function Neural Network, Second order Sliding Mode Control.

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