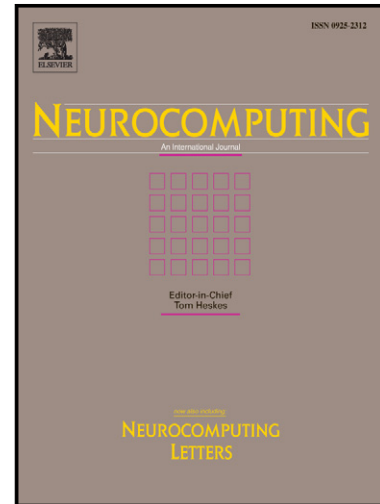


Author's Accepted Manuscript

A Second Order Sliding Mode Control and a Neural Network to Drive a Knee Joint Actuated Orthosis

S. Mefoued



www.elsevier.com/locate/neucom

PII: S0925-2312(14)01711-1
DOI: <http://dx.doi.org/10.1016/j.neucom.2014.12.047>
Reference: NEUCOM15000

To appear in: *Neurocomputing*

Received date: 19 April 2014
Revised date: 31 August 2014
Accepted date: 18 December 2014

Cite this article as: S. Mefoued, A Second Order Sliding Mode Control and a Neural Network to Drive a Knee Joint Actuated Orthosis, *Neurocomputing*, <http://dx.doi.org/10.1016/j.neucom.2014.12.047>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting galley proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

A Second Order Sliding Mode Control and a Neural Network to Drive a Knee Joint Actuated Orthosis

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.

* This work lies within the scope of project EICoSI (Exoskeleton Intelligently Communicating and Sensitive to Intention), sponsored by the regional council of Ile-De-France. This paper is based in part on the paper presented at the IEEE International Conference on Intelligent Robots and Systems (IEEE IROS, 2012).

Dr. Saber Mefoued received his PhD at the LISSI Laboratory, University of Paris-Est Créteil-France. E-mails: saber.mefoued@u-pec.fr.

Download English Version:

<https://daneshyari.com/en/article/6865949>

Download Persian Version:

<https://daneshyari.com/article/6865949>

[Daneshyari.com](https://daneshyari.com)