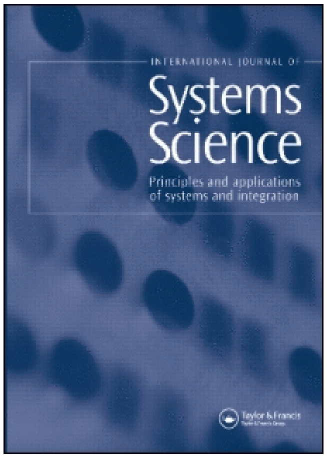

International Journal of Systems Science
Publication details, including instructions for authors and subscription information:
http://www.informaworld.com/smpp/title~content=t713697751

Editorial 2: Sliding mode observation and identification

Yuri B. Shtessel; Sarah K. Spurgeon; Leonid M. Fridman

Online Publication Date: 01 January 2007
To cite this Article: Shtessel, Yuri B., Spurgeon, Sarah K. and Fridman, Leonid M. (2007) 'Editorial 2: Sliding mode observation and identification', International Journal of Systems Science, 38:11, 845 - 846
To link to this article: DOI: 10.1080/00207720701679106
URL: http://dx.doi.org/10.1080/00207720701679106

International Journal of Systems Science
Vol. 38, No. 11, November 2007, 845–846

Editorial 2: Sliding mode observation and identification

The Special Issue of the International Journal of Systems Science on "Advances in Sliding Mode Observation and Estimation" is divided into two issues. The first one is dedicated to advances in HOSM-based observers; and the second one contains papers on new methods of identification and fault detection using the equivalent injection signal and a variety of applications of sliding mode observers.

In the second issue, the first block of three papers is devoted to sliding mode observer design for state, parameter and uncertainties identification in systems affected by noise.

The first paper in the block, "Sliding modes time varying matrix identification for stochastic systems" by A. Poznyak, J. Escobar and Y. Shtessel presents a sliding mode observer for time varying parameter identification of stochastic systems using the modified Matrix Forgetting Factor method. The equivalent output injection compensates a so-called Ito's term, which reflects the stochastic nature of the system. The state estimation error reaches zero in finite time with probability one. The upper bound of the estimation error is computed. It is proportional to the square norm of the time derivative of the parameter matrix as well as to the fourth-moment of the "regression input".

The next paper entitled "Sliding mode identification and control for linear uncertain stochastic systems" by M. Basin, A. Ferreira and L. Fridman presents a sliding mode observer design based on the integral sliding mode technique. The designed observer is applied to disturbance identification and robustification of the optimal Linear Quadratic Gaussian (LQG) controller for linear uncertain stochastic systems. It is shown that the corresponding equivalent output injection allows uncertain terms to be identified.

The third paper in this block, "Sliding mode parameter identification of systems with measurement noise" by S. Baev, I. Shkolnikov, Y. Shtessel, and A. Poznyak addresses the parameter identification problem in a nonlinear system with constant coefficients. Traditional and high-order sliding mode parameter observers are designed using the least-squares continuous-time technique. Measurement noise effects on the parameter estimation algorithm are analyzed. The effectiveness of the proposed method is verified via the parameter estimation in a second-order system with noisy measurement.

The second block of papers comprises four papers dedicated to the application of sliding mode observers to fault detection, unknown input identification in induction motors, and chaotic systems synchronization.

A robust fault detection and diagnosis scheme for an abrupt and incipient class of faults that can affect the state of a class of nonlinear systems is presented in the paper "Robust fault detection and diagnosis in a class of nonlinear systems using a neural sliding mode observer" by Q. Wu and M. Saif. A nonlinear observer that integrates sliding mode techniques and neural state space models is proposed for on-line health monitoring. The sliding mode term is utilized to eliminate the effect of system uncertainties on the state observation. The switching gain of the sliding mode is updated via an iterative learning algorithm and an iterative fuzzy model, respectively. A bank of neural state space models is adopted to estimate various state faults. Robustness with respect to modeling uncertainties, fault sensitivity, and stability of this neural sliding mode observer-based fault diagnosis scheme are rigorously investigated.

N. Patel, C. Edwards, and S. K. Spurgeon propose a sliding mode based scheme for optimal deceleration in an automotive braking manoeuvre in the paper "Optimal braking and estimation of tyre friction in automotive vehicles using sliding modes". The scheme is model-based and seeks to maintain the longitudinal slip value associated with the tyre road contact patch at an optimum value, the point at which the friction coefficient-slip curve reaches a maximum. The scheme assumes that only wheel angular velocity is measured, and uses a sliding mode observer to reconstruct the states and a parameter relating to road conditions for use in the controller. The sliding mode controller then seeks to maintain the vehicle at this optimal slip value through an appropriate choice of sliding surface.

The paper "A sliding mode observer for sensorless induction motor speed regulation" by C. Aurora and A. Ferrara presents a novel sliding mode observer for current based sensorless speed control of induction motors. The control objective is to guarantee asymptotic tracking of prespecified references for speed and rotor

International Journal of Systems Science
ISSN 0020–7721 print/ISSN 1464–5319 online © 2007 Taylor & Francis
http://www.tandf.co.uk/journals
DOI: 10.1080/00207720701679106

flux magnitude, without sensors measuring the mechanical speed and the flux, and assuming to have some kind of uncertainties on the value of the rotor resistance. The proposed observer is designed by coupling a second-order sliding mode observer of stator current with a non-linear and speed observer, adaptive with respect to the rotor resistance. Estimation of unknown inputs is based on a different and original approach with respect to the widely used equivalent output injection.

The performance of adaptive sliding mode observers (ASMO) in chaotic synchronization and communication in the presence of uncertainties is studied in the paper ''Smooth adaptive sliding mode observers in uncertain chaotic secure communication'' by R. Raoufi and A.S.I. Zinober. The proposed robust adaptive observer-based synchronization is used for cryptography based on nonlinear chaotic masking modulation (NCM). Uncertainties are intentionally injected into the chaotic dynamical system to achieve higher security, and the robust sliding mode observer design methods are employed for estimating the uncertain nonlinear dynamics. In addition, a relaxed matching condition and a boundary layer smooth gain are introduced to implement the robust observer design more feasibly.

Yuri B. Shtessel
Huntsville, Alabama, USA
Sarah K. Spurgeon
Leicester, UK
Leonid M. Fridman
Mexico DF, Mexico, 2007