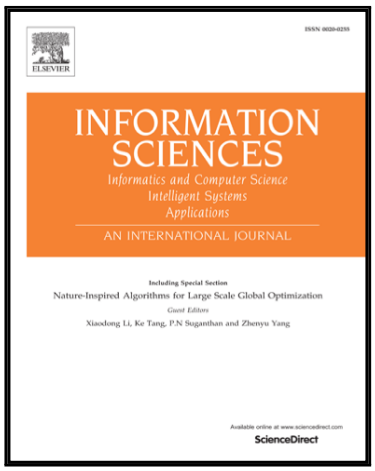

Stability Analysis of Nonlinear Telerobotic Systems with Time-varying Communication Channel Delays Using General Integral Inequalities

R. Baranitha, R. Rakkiyappan, Reza Mohajerpoor, Saba Al-Wais

PII: S0020-0255(18)30528-0
DOI: 10.1016/j.ins.2018.07.014
Reference: INS 13781

To appear in: *Information Sciences*

Received date: 2 January 2018
Revised date: 3 July 2018
Accepted date: 7 July 2018

Please cite this article as: R. Baranitha, R. Rakkiyappan, Reza Mohajerpoor, Saba Al-Wais, Stability Analysis of Nonlinear Telerobotic Systems with Time-varying Communication Channel Delays Using General Integral Inequalities, *Information Sciences* (2018), doi: 10.1016/j.ins.2018.07.014

Stability Analysis of Nonlinear Telerobotic Systems with Time-varying Communication Channel Delays Using General Integral Inequalities

R. Baranitha[a], R. Rakkiyappan[a,*], Reza Mohajerpoor[b], Saba Al-Wais[c]

[a]*Department of Mathematics, Bharathiar University, Coimbatore- 641 046, Tamil Nadu, India*
[b]*School of Civil Engineering, The University of Sydney, Australia*
[c]*University of Technology, Baghdad 00964, Iraq*

Abstract

Existing controller synthesis schemes for teleoperation of nonlinear master-slave systems with time-varying communication channel are subject to conservative stability criteria. This paper presents a new stability criteria for bilateral teleoperation systems with proportional-derivative, position-position and position-force control architectures, considering both passive/non-passive human operator. The communication channel pertains unknown asymmetric time-varying delays with given lower and upper-bounds. Using the Lyapunov Krasovskii approach, the stability analysis of the dynamic system is examined and the stability conditions are derived in the form of Linear Matrix Inequalities (LMIs). Advanced techniques have been employed to find less conservative integral inequalities in the process of stability analysis of the closed-loop teleoperator. Illustrative numerical examples and simulation results emphasize the effectiveness of the proposed stability criteria in enlarging the stability bounds and providing efficient control performances.

Keywords: Bilateral teleoperation, Linear Matrix Inequality, Passive teleoperator, Position-Position and Position-Force control architectures

*Corresponding author
Email address: rakkigru@gmail.com (R. Rakkiyappan[a,*])