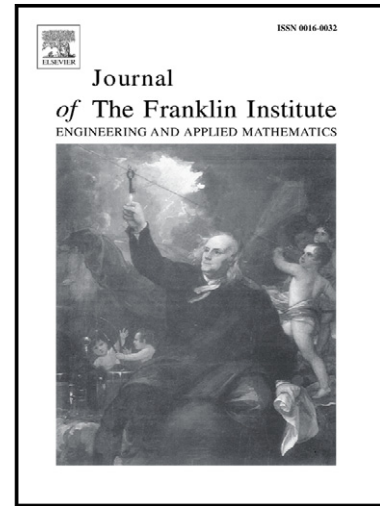


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On fault-tolerant control configurations for a class of nonlinear systems

Linlin Li^a, Ying Yang^{b,*}, Steven X. Ding^a, Yong Zhang^b, Shouchao Zhai^c

^a*Institute for Automatic Control and Complex Systems (AKS), Faculty of Engineering, University of Duisburg-Essen, 47057 Duisburg, Germany*

^b*State Key Lab for Turbulence and Complex Systems, Department of Mechanics and Engineering Science, College of Engineering, Peking University, Beijing 100871, P.R. China*

^c*Department of Automation, Tsinghua University, Beijing 100084, P.R. China*

Abstract

This paper studies the configurations of fault-tolerant controllers for affine nonlinear systems. The design philosophy is highlighted by the observer and residual generator based controller parametrization and the integration of a fault diagnosis system. To be specific, a novel interpretation for the design of fault-tolerant controllers is first introduced with the combination of any stabilizing controller and a residual-driven dynamic compensator. It allows us to attain the separate design of system stability performance and fault tolerance. Under such circumstances, the whole design procedures finally realize the maintenance and life-circle management of affine nonlinear systems. In the end, a design scheme of the fault-tolerant control framework is proposed.

Keywords: Affine nonlinear systems, detectable kernel representation, fault diagnosis, fault-tolerant control configuration

1. Introduction

In the past decades, the coprime factorization technique has been playing an essential role in deriving the Youla parametrization for linear time-invariant (LTI) systems [1, 2]. Numerous controller parametrization schemes, developed from Youla parametrization, have been proposed to improve the system performance [3, 4]. Some researchers have made the effort to generate the coprime fractional representations to nonlinear cases [5]. Available design schemes that generalize the Youla parametrization to nonlinear systems can be found in [6, 7], either by using left coprime factorization (LCF) or right coprime factorization (RCF). However, due to the lack of a separability property in nonlinear case, it is difficult to formulate the LCF of nonlinear systems [8]. Kernel representation, as the generalization of LCF, is utilized instead to derive Youla parametrization and all the stabilizing Plant-Controller pairs for nonlinear systems [9].

*Corresponding author. Tel: +86 10 6275 1815; fax: +86 10 6276 4044

Email addresses: linlin.li@uni-due.de (Linlin Li), yy@mech.pku.edu.cn (Ying Yang), steven.ding@uni-due.de (Steven X. Ding), yong.zhang@pku.edu.cn (Yong Zhang), dsc06@mails.tsinghua.edu.cn (Shouchao Zhai)

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