

Author's Accepted Manuscript

On the distinguishability and observer design for single-input single-output continuous-time switched affine systems under bounded disturbances with application to chaos-based modulation

David Gómez-Gutiérrez, C.R. Vázquez, Sergej Čelikovský, Antonio Ramírez-Treviño, Bernardino Castillo-Toledo



PII: S0947-3580(16)30268-0
DOI: <http://dx.doi.org/10.1016/j.ejcon.2016.12.005>
Reference: EJCON191

To appear in: *European Journal of Control*

Received date: 18 December 2015
Revised date: 15 December 2016
Accepted date: 19 December 2016

Cite this article as: David Gómez-Gutiérrez, C.R. Vázquez, Sergej Čelikovský, Antonio Ramírez-Treviño and Bernardino Castillo-Toledo, On the distinguishability and observer design for single-input single-output continuous time switched affine systems under bounded disturbances with application to chaos-based modulation, *European Journal of Control* <http://dx.doi.org/10.1016/j.ejcon.2016.12.005>

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

On the distinguishability and observer design for single-input single-output continuous-time switched affine systems under bounded disturbances with application to chaos-based modulation

David Gómez–Gutiérrez^{a,*}, C. R. Vázquez^b, Sergej Čelikovský^{c,d}, Antonio Ramírez–Treviño^e, Bernardino Castillo–Toledo^e

^aAutonomous Systems Lab, Intel Labs, Intel Tecnología de México, Av. del Bosque 1001, Colonia El Bajío, 45019, Zapopan, Jalisco, México.

^bTecnológico de Monterrey, Campus GDA, Av. General Ramón Corona 2514, 45201, Zapopan, Jalisco, México.

^cInstitute of Information Theory and Automation, Czech Academy of Sciences, P.O. Box 18, 182 08 Prague, Czech Republic.

^dCzech Technical University in Prague, Faculty of Electrical Engineering, Department of Control Engineering, Technická 2, 166 27 Prague, Czech Republic.

^eCINVESTAV, Unidad Guadalajara, Av. del Bosque 1145, colonia el Bajío, Zapopan, 45019, Jalisco, México.

Abstract

Switched Affine Systems (SAS's) is a class of Hybrid Systems composed of a collection of Affine Systems (AS's) and a switching signal that determines, at each time instant, the evolving affine subsystem. This paper is concerned with the observability and observer design for single-input single-output (SISO) SAS's under unknown perturbation, for the case that no information about the switching signal is available. It is firstly demonstrated that in the presence of disturbances every pair of AS's is always indistinguishable from the continuous output, meaning that it is not possible to infer the evolving AS by using only the information provided by the output of the SAS. Nevertheless, by taking advantage of the knowledge on the disturbance bound, new distinguishability conditions are derived, making possible to distinguish the evolving AS. By using these new distinguishability conditions, an observer scheme for SISO SAS's, subject to unknown switching signal and unknown perturbations, is presented. Such observer scheme determines in finite-time the evolving AS. Furthermore, it estimates both the state of the system and the disturbance. Finally, the proposed observer scheme is effectively applied for a non-autonomous chaotic modulation application, which is an attractive method for spread-spectrum secure communication in which the message is fed as a disturbance to a chaotic SAS and the output is then transmitted through an open channel to a receiver, which is an observer algorithm that recovers the message (the disturbance) from the output signal.

Keywords: Switched linear systems, unknown input observers, chaos-based modulation, chaotic synchronization, message-embedding.

1. Introduction

Switched Affine Systems (SAS's) are composed of a collection of Affine Systems (AS's) and a switching signal determining, at each time instant, the evolving affine subsystem. Although SAS's are formed of simple AS's, this class of systems may exhibit highly non-linear behaviors, such as chaos [1–8], under a suitable selection of the affine subsystems and the switching rule.

SAS's are interesting models for applications in different engineering areas. For instance, process systems frequently include the operation of discrete actuators, each combination of the actuators states leads to an operation

*Corresponding Author.

Email addresses: David.Gomez.G@ieee.org (David Gómez–Gutiérrez), cr.vazquez@itesm.mx (C. R. Vázquez), celikovs@utia.cas.cz (Sergej Čelikovský), art@gdl.cinvestav.mx (Antonio Ramírez–Treviño), toledo@gdl.cinvestav.mx (Bernardino Castillo–Toledo)

Download English Version:

<https://daneshyari.com/en/article/5001722>

Download Persian Version:

<https://daneshyari.com/article/5001722>

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