Accepted Manuscript

On common noise-induced synchronization in complex networks with state-dependent noise diffusion processes

Giovanni Russo, Robert Shorten

PII: S0167-2789(17)30351-2
DOI: https://doi.org/10.1016/j.physd.2018.01.003
Reference: PHYSD 31997

To appear in: *Physica D*

Received date : 26 June 2017
Revised date : 4 January 2018
Accepted date : 5 January 2018

Please cite this article as: G. Russo, R. Shorten, On common noise-induced synchronization in complex networks with state-dependent noise diffusion processes, *Physica D* (2018), https://doi.org/10.1016/j.physd.2018.01.003

On common noise-induced synchronization in complex networks with state-dependent noise diffusion processes

Giovanni Russo[a,*], Robert Shorten[b]

[a] *IBM Research Ireland, Optimization and Control Group*
[b] *University College Dublin, School of Electrical and Electronics Engineering*

Abstract

This paper is concerned with the study of common noise-induced synchronization phenomena in complex networks of diffusively coupled nonlinear systems. We consider the case where common noise propagation depends on the network state and, as a result, the noise diffusion process at the nodes depends on the state of the network. For such networks, we present an algebraic sufficient condition for the onset of synchronization, which depends on the network topology, the dynamics at the nodes, the coupling strength and the noise diffusion. Our result explicitly shows that certain noise diffusion processes can drive an unsynchronized network towards synchronization. In order to illustrate the effectiveness of our result, we consider two applications: collective decision processes and synchronization of chaotic systems. We explicitly show that, in the former application, a sufficiently large noise can drive a population towards a common decision, while, in the latter, we show how common noise can synchronize a network of Lorentz chaotic systems.

Keywords: Synchronization, Complex Networks, Noise-induced phenomena

1. Introduction

Over the past years, noise induced synchronization has been the subject of much research effort; see e.g. [1, 2, 3, 4] and references therein. The interest in

*Corresponding author
Email address: grusso@ie.ibm.com (Giovanni Russo)