Research Grants for PhD students from the China Scholarship Council

Information Form (please read the guidelines carefully on the website www-csc.utt.fr)

Supervisor's name : BOUTAT Given names : Driss

Status (prof., assistant prof., …) : Professor

Laboratory :	PRISME	Website address :	http://www.univ-orleans.fr/en/prisme
Institution :	INSA Centre Val de Loire	Website address :	http://www.insa-centrevaldeloire.fr/

Scientific competence of the supervisor:

Prof. Boutat is an international expert on control and observation for non-linear and fractional dynamic systems. Until now, he has published more than 130 journal and conference articles. He is supervisor of 14 PhD students (10 have defended). From 2011 to 2017, he was leader of the control team in PRISME. Moreover, he is member of Editorial Board of Discrete Dynamics in Nature and Society and of Mediterranean Journal of Measurement and Control. He earned the Order of Academic Palms Chevalier (Knight) since January 2010. From 2017 to 2020, he is appointed as a foreign expert of high level by the Chinese government.

Two major publications in the field proposed for the PhD :

1. Wei Y.Q., Liu D.Y., Boutat D., Innovative fractional derivative estimation of the pseudo-state for a class of fractional order linear systems, Automatica, Vol. 99, pp. 157-166, 2019.
2. Boutat D., Extended nonlinear observer normal forms for a class of nonlinear dynamical systems, International Journal of Robust and Nonlinear Control, Vol. 25, pp. 461 – 474, 2015.

Website address of the personal page : https://www.researchgate.net/profile/Driss_Boutat

Supervisor's email : driss.boutat@insa-cvl.fr

Description of the research work proposed for a PhD ***Topic # (see list) :*** I-17

Title : Non-asymptotic Estimation Approaches for Fractional Order Nonlinear Systems

Subject :

Fractional calculus was introduced in many fields of science and engineering long time ago. It has gained great interest in several applications. For instance, fractional order systems and controllers have been applied to improve performance and robustness properties in control design. For engineers, there is always a need of knowing the states of a system in order to make important decisions, to control the system, or to predict reliably its future states. The concept of observers has been introduced to efficiently estimate the states of a system. However, it is usually difficult to design an observer for a nonlinear system. In order to solve this problem, the so-called Nonlinear Observer Normal Forms (NONFs) have been introduced for nonlinear systems during the 1980s. The idea is to transform a nonlinear system into a NONF on which existing observer methods can be applied. Recently, the theory on the NONFs has been widely developed and promising results have been obtained. Very recently, a type of algebraic observers have been proposed by applying the non-asymptotic estimation methods, which are non-asymptotic, and robust against corrupting noises. They have been applied in many fields, such as signal processing, control, robotic, etc. The objective of this thesis is to extend the non-asymptotic estimation methods for fractional order non-linear systems, using the concept of NONF.

Keywords :

Nonlinear Fractional Order Systems; Nonlinear Observer Normal Forms, Non-asymptotic Estimation Approaches.

Expected collaborations :

The second supervisor of this thesis is Dr. D.Y. Liu. His main research interests concern with estimation and identification for integer order systems and fractional order systems, such as state estimation and parameter identification. Until now, he has published more than 60 journal and conference papers. Since October 2017, he is member of IFAC's Technical Committee: 2.2 Linear Control Systems. Since May 2019, he becomes editorial board member of the journal of Fractal and Fractional.

Background required from the applicant :

Strong background in mathematics and control; Very good knowledge in mathematical methods applied to control theory, such as differential equations and differential geometry.

Existence of a PDF file detailing the proposal ("yes" or "no") : Yes

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