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 dynamic systems. Until now, he has published more than 100 journal and conference articles. He is supervisor of 9 PhD students (5 have defended). From 2011 to 2017, he was leader of the control team in PRISME. Moreover, he is associate editor of Journal of Nonlinear Dynamics, 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, 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. X. Wei, D.Y. Liu and D. Boutat, Non-asymptotic state estimation for a class of fractional order linear systems, IEEE Transactions on Automatic Control, 62(3), 1150-1164, 2016.
2. D.Y. Liu, G. Zheng and D. Boutat, H.R. Liu, Non-asymptotic fractional order differentiator for a class of fractional order linear systems, Automatica, 78, 61-71, 2017.

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 distribution approach for fractional order 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 this reason, many identification techniques have been developed to model these fractional order systems. While the most popular technique of Pade approximation is limited by the range of validity of the approximation, most of the other approaches generally suffer from poor speed performance. Moreover, there often exist faults in actuator and sensor of a system. Hence, many different fault diagnosis approaches have been proposed for integer order systems. However, less attention has been paid for fractional order systems. Recently, a fast parameters identification method which is based on distribution theory has been proposed for continuous dynamical systems. This method is algebraic, thus non-asymptotic, and robust against corrupting noises. It has been applied in many fields, such as signal processing, control, robotic, etc. Bearing these ideas in mind, the objective of this thesis is to extend the distribution based approach to fractional order systems for parameter identification such as time delay, fault diagnosis, and state estimation.

Keywords :

Fractional calculus, Non-asymptotic algebraic approach, Distribution theory, Parameter identification, Fault diagnosis, Time-delay.

Expected collaborations :

The second supervisor of this thesis is Dr. D.Y. Liu. Dr. Liu's 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 50 journal and conference papers. Thanks to his PhD work, he earned the Chinese Government award for outstanding self-financed students abroad. Moreover, his student Xing Wei also earned this award in 2017. In 2018, his student Ang Li earned the Excellent Eiffel award.

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 distribution theory.

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

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