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 :	LAGHROUCHE	Given names :	SALAH
Status (prof., assistant prof., …) :	Professor		
Laboratory :	FEMTO-ST Institute	Website address :	https://www.femto-st
Institution :	University of Technology of Belfort-Montbéliard (UTBM),	Website address :	https://www.utbm.fr/english/

Scientific competence of the supervisor:

S. LAGHROUCHE is Full Professor in control engineering at UTBM FEMTO-ST. He has been directed numerous National and European projects and has the experience of working with global, leading industrial partners. Dr. Laghrouche research interests include variable structure systems, automotive and fuel cell control systems, renewable and smart energy management and power systems. Dr. Laghrouche serves as an Editorial Board Member for IEEE/ASME Transactions on Mechatronics, International Journal of Robust and Nonlinear Control, Journal of The Franklin Institute, and Asian Journal of Control. He is a member of the Conference Editorial Board of IEEE Control

Two major publications in the field proposed for the PhD :

1. CD Cruz-Ancona, L Fridman, H Obeid, S Laghrouche, CA Pérez-Pinacho, A uniform reaching phase strategy in adaptive sliding mode control, Automatica 150, 110854, 2023.
2. S. Laghrouche, M. Harmouche, Y. Chitour, H. Obeid and L. Fridman. Barrier Function-Based Adaptive Higher Order Sliding Mode Controllers, Automatica, Volume 123, 109355, 2021.

Website address of the personal page : https://scholar.google.fr/citations?user=wDS6t8EAAAAJ&hl=fr

Supervisor's email : salah.laghrouche@utbm.fr

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

Title : Nonlinear Modeling and Advanced Control of Electrolyzers

Subject :

This thesis proposes innovative models and controls for electrolyzers, aimed at maximizing their energy efficiency and increasing their robustness. Two major challenges are at the heart of this research. The first is the development of reliable nonlinear analytical models for the design of advanced controllers. The second is the creation of robust, adaptive control systems that build on these models to enable electrolyzers to operate efficiently over a wide range of conditions, thereby overcoming the limitations of traditional linearization techniques. These issues are attracting particular attention from the scientific community due to the complex and highly non-linear nature of electrolytic systems. Although the literature offers sophisticated nonlinear models with a high degree of fidelity, their complexity makes direct application in control systems difficult, requiring simplified reformulations of critical dynamics while preserving the essence of the original models. Furthermore, in the face of considerable external disturbances and sometimes unmodeled or unknown dynamics, it is crucial that controllers are both robust and adaptive. In this context, robust and adaptive sliding-mode control is a promising strategy for effectively countering these disturbances and guaranteeing excellent performance over a wide range of operational conditions.

Keywords :

Electrolyzers, Nonlinear Analytical Models, Advanced Controllers, Adaptive Control Systems

Expected collaborations :

Background required from the applicant :

The ideal candidate would have a strong foundation in applied mathematics and focused expertise in either optimization, control engineering, or electrical engineering. Additionally, they should exhibit a satisfactory level of competence in dealing with dynamic modeling and nonlinear control systems.

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

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