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1 GENERAL INFORMATIONS

Laboratory	FEMTO-ST
University	University of Technology of Belfort-Montbéliard (UTBM),
Supervisors	Salah LAGHROUCHE, associate professor

2 THESIS TITLE AND KEYWORDS

Barrier function-based adaptive higher order sliding control

Keywords: Adaptive sliding modes, Barrier function, Higher order sliding modes, control, observers

3 PROJECT POSITION WITH

Most physical systems are considered as uncertain and complex systems. Indeed, the complexity results from the non-linear relationship between the system states, the number of unknown parameters, and the external disturbances acting on the system. In recent years, a considerable effort has been focused on developing new advanced control techniques that ensure optimal and robust control of these systems.

Sliding mode control dedicated to the control of nonlinear systems is well known for its robustness qualities needed in a large number of applications. However, the constraints imposed by the apriori knowledge of the uncertainty bounds that affect the system model limit its application. Recently, the concept of barrier function-based adaptive higher order sliding mode control has appeared which allows to overcome this difficulty.

4 THESIS OBJECTIVES

The objectives of this thesis are multiple:

- Generalization and extension of the universal concept of the barrier-function to more general classes of systems (e.g. multivariable systems)
- Application of the barrier concept to ensure stability in a predefined time
- Generalization of the barrier concept to continuous higher order sliding mode control.
- Generalization of the barrier concept to the terminal sliding mode technique
- Effective applications of the developed techniques on real physical systems to demonstrate their efficiency.

5 BACKGROUND REQUIRED FROM THE APPLICANT

The applicant should have a solid background in applied mathematics and control theory.

6 EXPECTED COLLABORATION

This thesis will be conducted in close collaboration with Professor Leonid FRIDMAN (UNAM, Mexico) and Professor Yacine CHITOUR (Paris-Saclay University).

7 RÉFÉRENCES

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