



Tutorial Session.

Title: Intelligent Fault Tolerant Control Systems - Application to Industrial Processes and X8-Quadcopter Drones.

Instructors: Professor Luis Brito Palma and Bachelor Vasco Silva Brito.

Abstract. A typical feedback control structure for an industrial process plant or vehicle system may result in unsatisfactory closed-loop performance, in the event of faults or failures in actuators, sensors, controllers or other components of the overall system. Faults or failures can also generate dangerous situations for humans or machines, reduce products quality, and cause economic losses.

Intelligent fault tolerant control systems (I-FTCS) should guarantee that faults don't provoke dangerous failures, using intelligent fault detection / diagnosis and fault tolerance approaches.

The tutorial aims to present theoretical concepts, in a comprehensive and integrated framework, related to dynamical systems, classical control techniques, fault detection / diagnosis and intelligent fault tolerant control approaches. Besides concepts, industrial and academic experiences are to be transmitted to the audience, as well as new challenges in these fields.

In order to clarify the concepts, simulations and real applications in the industrial processes field, and also in multi-rotors drones, will be presented.

Main tutorial topics:

- dynamical signals and systems: modeling and system identification;
- linear and nonlinear control techniques;
- optimization approaches;
- control loop performance analysis;
- faults and failures concepts;
- fault detection techniques;
- fault diagnosis techniques;
- intelligent fault tolerant control approaches;
- industrial processes applications;
- X8-quadcopter drones: kinetics and dynamics modeling, identification, simulation in Matlab/Simulink and in virtual reality environment, real world experiments, and intelligent fault tolerant control;
- concluding remarks and future trends;
- discussion with the audience.

Short CV. Luis Brito Palma.



Luis Brito Palma received the Licentiate Degree in Physics Engineering and the PhD degree in Electrical Engineering from the Faculty of Sciences and Technology (FCT) of New University of Lisbon (UNL), Portugal, in 1991 and 2007, respectively. The PhD thesis is entitled "Fault Detection, Diagnosis and Fault Tolerance Approaches in Dynamic Systems based on Black-Box Models".

In 1990 he worked at INETI Institute in the optoelectronics and lasers areas. From 1990 to 1992 he worked at INESC Institute in the electronics and image processing areas. In 1992 he has been Teaching Assistant in the Physics Department at FCT-UNL within electronics area. From 1993 to 1998 he has been Teaching Assistant in the Electrical Engineering Department at FCT-UNL within electrotechnical, electronics, automation and control areas. From 1998 to 2007 he has been Research and Teaching Assistant in the Electrical Engineering Department at FCT-UNL within dynamical signals and systems, automation and control areas.

From 2007 to present, he has been a Professor of Decision and Control Systems at Electrical Engineering Department at FCT-UNL, and also a Researcher at Uninova-CTS Research Institute, Caparica - Lisboa, Portugal.

The main research interests are automation, fault detection / diagnosis, intelligent fault tolerant control systems, industrial process control, aeronautical control systems and distributed systems. He has authored and co-authored more than 100 scientific papers in journals and international conferences. He supervised 7 Licentiate students, 20 MSc students and now 1 ongoing PhD student.

Short CV. Vasco Silva Brito.



Vasco Silva Brito received the Bachelor Degree in Electrical and Computer Engineering Sciences from the Faculty of Sciences and Technology of New University of Lisbon, Portugal, in 2014. Currently he is at the final stage of the MSc work with a thesis entitled "Fault Tolerant Control of a X8-VB Quadcopter".

In 2013 he has worked in the electronics area, for instance the development of audio tube power amplifiers. In 2014 he developed and implemented PID industrial controllers embedded in microcontrollers.

In 2015 he participated in a national Siemens contest with a project entitled "Hybrid System of Distributed Automation", regarding distributed automation and fault tolerant control systems, reaching the final stage.

From the beginning of 2016 he has been a Researcher at Uninova-CTS Research Institute, Caparica - Lisboa, Portugal, in the areas of dynamical signals and systems, intelligent fault tolerant control systems, aeronautical systems and multi-rotors drones.