



Speaker3: Prof Abdel Aitouche, University of Lille, CRISAL, France

Talk Title: *Robust Fuzzy Fault Tolerant Control of Wind Energy Systems subject to sensor and actuator faults*

The dynamic behavior of wind turbines varies widely along their operating range. Robust controllers, which are specifically designed to cope with nonlinear dynamics through the use of linearization techniques and other methods have been widely applied to the design of wind turbine control systems. Nonlinearities and system uncertainties are the most important difficulties in designing controllers that ensure stability and acceptable closed-loop performance.

A robust fuzzy scheduler fault tolerant control is proposed to tackle multivariable nonlinear systems subject to sensor faults, actuator faults and parameter uncertainties. Takagi–Sugeno fuzzy model is employed to represent the nonlinear wind energy systems, and then a model-based fuzzy scheduler controller design use the concept of general-distributed compensation. Takagi–Sugeno fuzzy systems are classified into three families based on the input matrices and a fault tolerant control synthesis procedure is given for each family. In each family, sufficient conditions are derived for robust stabilization, in the sense of Lyapunov method and Taylor series stability, for the Takagi–Sugeno fuzzy system with parametric uncertainties, sensor faults, and actuator faults. The sufficient conditions are formulated in the format of linear matrix inequalities. The effectiveness of the proposed controller design methodology is finally demonstrated through a wind energy system with doubly fed induction generators to illustrate the effectiveness of the proposed method.

Biography

Abdel Aitouche was born in Algiers and he received his diploma of Engineer in Supelec (France) in 1980 in Electrotechnique. He joined SONELEC in 1980 and after A company of RadioNavigation since 2 years. He joined the Institute Algerian of Petroleum (IAP) in 1983 at 1987. He got his PHD Thesis in University of Nancy I in 1990 in the field of Automation. Abdel Aitouche was lecturer in Hautes Etudes d'Ingénieurs de Lille, France (Graduate School of Engineering) since 1991 and Professor since 2009. He is Searcher at Center of research in Informatics, Signal and Automation, Lille (CRISAL) since 1997 (associated with the CNRS, French National Center For Scientific Research). Since 2020, he belongs to the team Softe (System OF SysTem Engineering) of CRISAL. He is Emeritus Searcher at the Laboratory CRISAL since October 2022, University of Lille. He is member of MCA (Mediterranean Control Society) and member of INCOSE (International Council on Systems Engineering). Aitouche's research interests' concern fault tolerant systems (FTS), nonlinear control and fault tolerant control (FTC) and model based fault detection and diagnosis (FDD). Their application domains are mainly intelligent, embedded systems, process engineering, combustion engine, fuel cells and renewable energy (Wind, PV). He has published more than 300 papers