The 13th European Workshop on Advanced Control and Diagnosis (ACD 2016), www.acd2016.eu took place at Hautes Etoiles d’Ingénieur (HEI), Lille, France, on November 17-18, 2016.

The annual European Workshop on Advanced Control and Diagnosis has been organized since 2003 by Control Engineering departments of several European universities in Germany, France, the UK, Poland, Italy, Hungary, Denmark and Czech Republic, to bring together senior and junior academics and engineers from diverse fields of automatic control, fault detection, and signal processing. The workshop provides an opportunity for researchers and developers to present their recent theoretical developments, practical applications, or even open problems. It also offers a great opportunity for industrial partners to express their needs and priorities and to review the current activities in the fields.

A total of 100 papers have been submitted for ACD 2016. Based on the peer reviews 71 papers were accepted for oral presentation, 4 papers withdrawn, 3 papers not presented. The accepted papers covered areas of Fault Diagnosis, Estimation and Observation, Fault Tolerant Control, Predictive Control, Robust Control, Control Theory, fractional order systems, Modeling and Data Processing, Software tools and code generation. In addition, four excellent plenary lectures were delivered by experts on their domain: Ir. Serge Legonidec from the company Airbus Safran Launchers, France: An overview of connections between scientific automatic topics and their applications in the propulsive systems, Dr. Ir. Jan-Willem Van Wingerden, Technical University of Delft, Nederland: Wind Energy Control Research, Prof. Sarah Spurgeon, University College London, UK: On
discontinuous Observers: From Basic Properties to a Robust Fault Detection and Condition Monitoring Tool, Dr. Joseph-Julien Yame, University of Lorraine, Nancy, France: Data Driven Fault Tolerant Control: a behavioral approach.

The ACD 2016 has been co-sponsored technically by the International Federation of Automatic Control (IFAC).

On behalf of the ACD 2016 organizing committee, we would like to thank all those who prepared and submitted papers, participated in the peer review process, supported, and attended the workshop.

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Plenary Lectures

Serge Le Gonidec: Airbus Safran Launchers, France

Title: An overview of connections between scientific automatic topics and their applications in the propulsive systems

Abstract: In the space propulsion applications the automatic topics have a significant contribution. Indeed, from development to post flight analysis, through the overall life cycle, the automatic tools allow or contribute (or could contribute in the future) to: Reduce the development and production cost, improve the trust accuracy and the reliability, make the engine control management more robust, improve the capability of flight mission agility, facilitate the post flight analysis, ....Of course all the ACD technologies are not currently in use or should not be applied even in future space context ! So a small "travel" in the space propulsion world from past studies through current applications to potential needs should illustrate the primary importance of the ACD technologies.

Biography: Serge Le Gonidec was born in France, in 1964. He started its carrier in 1985 at the “Société Européenne de Propulsion” with a BTS CIRA (French acronym for Industrial Automatic Control). In the support team “control, measurement and command system” on Ariane rocket engine test benches, he participated to the post-V18 return to flight. Early in 1990, the Ariane 5 program gave him the opportunity to work on the test bench control engineering (flow control, tank pressurization, turbine speed, etc.). These new A5 test benches allowed introducing the digital control and its generalization for the engine or component tests under a high required safety. At that time, he started the CNAM School and received the engineer certificate in 1997, with a specialization in “Industrial Control”. The topic of its memory was “System Identification in transient phases: Genetic Algorithm development and application”. In 1994, he rejoins the team of System department. Its activities are oriented modeling development and stability analysis for system developments or for the support for understanding the bad behaviors. After 1997, he contributed to the engine design (e.g. Vinci) or evolution (e.g. Vulcain2) in introducing the Multi-variable Predicted Control. In the same time, in relation with ESA or CNES, he worked on each space engine control project. In Space Engine Division at Snecma, its activities are mainly oriented on the R&T roadmap dedicated to automatic application and the support on the engine development. These R&T activities are focused on the preparation of the integration of the engine automatic control (system, engineering methodology, equipment, electrification, ...) and on the health monitoring system for the future launchers (reusable launchers, control and monitoring interaction / IVHM / AFTC, automatic support to the flight analysis, ...). He participated to the deployment of the first HIL test bench dedicated to the beginning of electric space engine demonstration. During 5 years he managed the R&T project dedicated to monitoring for space engine application (7 countries) in the frame of ESA activities. In parallel, the Snecma diversification activities brought him to work on the Fuel Cell control. In these related thematic, he deployed the methodology for system stability analysis for the application of the anomaly investigation or for support to the design of the multi-physic systems. Since 2008, he is referent expert « Expert Senior » on the « space systems control & monitoring » in the Safran group. In the frame of the new company « Airbus Safran Launchers » entity, he is a member of the Audit team. Currently, its preoccupations are concentrated on the electric and the control functions deployment on the space propulsion systems and the associated engineering system development methodology. Up to now, he is the author of about 40 edited or in proceed filing patents.
Dr. ir Jan-Willem van Wingerden: TU Delft / DCSC, Room 34 C-2-320 Mekelweg 2, 2628 CD Delft, Nederland

Title: Wind Energy Control Research

Abstract: In this presentation I will give an overview of my research in the area of control of wind turbines and farms. After a brief history on how developments in control theory and technologies contributed to the development of large-scale variable-speed wind turbines, novel control technologies and the corresponding research challenges will be presented. This will include: Lidar control, control of floating wind turbines, control of wind farms and "smart" rotor control.

Biography: Dr. ir. Jan-Willem van Wingerden, was born on December 9, 1980 in Ridderkerk, The Netherlands. In 1999 he started his study Mechanical Engineering at the Delft University of Technology, where he graduated cum laude in December 2004 at the Control Engineering group, nowadays part of the Delft Center for Systems and Control (DCSC). His graduation project was carried out at Philips Applied Technologies in Eindhoven. In January 2005, he started his Ph.D. project entitled: 'Smart' dynamic rotor control for large offshore wind turbines within the Delft Center for Systems and Control and the Delft University Wind Energy Research Institute. In 2008, he received his Ph.D. degree Cum Laude from the Delft Center of Systems and Control, Delft University of Technology. In 2010 he was a visiting scientist at the National Renewable Energy Lab. (USA). Currently he is an associate professor at the Delft University of Technology. His main research interests include system identification, robust control, and control and identification wind energy systems.
**Prof. Sarah Spurgeon** : Department of Electronic and Electrical Engineering, University College London, UK.

**Title:** On discontinuous Observers: From Basic Properties to a Robust Fault Detection and Condition Monitoring Tool.

**Abstract:** Sliding mode observers have generated a ground swell of interest in recent years. These observers have unique properties. Their ability to force the error between the measured plant output and the output of the observer to be identically zero produces a set of state estimates that are precisely commensurate with the actual output of the plant. It is also the case that analysis of the applied observer injection signal, the so-called equivalent injection signal, contains useful information about the mismatch between the model used to define the observer and the actual plant. This lecture presents an overview of both linear and non-linear sliding mode observer paradigms. The use of the equivalent injection signal in problems relating to fault detection and condition monitoring is demonstrated. A number of applications specific results are also described.

**Biography Prof. Sarah Spurgeon OBE, FREng, FlnstMC, FIET, FIMA** is Professor of Control Engineering and Head of the Department of Electronic and Electrical Engineering at University College London and President of the Institute of Measurement and Control in the UK. Sarah Spurgeon’s research interests are in the area of systems modelling and analysis, robust control and estimation in which areas she has published over 270 refereed research papers. She was awarded the Honeywell International Medal for ‘distinguished contribution as a control and measurement technologist to developing the theory of control’ in 2010 and an IEEE Millenium Medal in 2000. She is currently a member of the Council of the International Federation of Automatic Control (IFAC) and a member of the General Assembly of the European Control Association. Within the UK she is an independent member of the Defence Scientific Advisory Council (DSAC) which provides independent advice to the Secretary of State for Defence on science, technology, engineering, analysis and mathematics matters and is also a Board Member of EngineeringUK.
Dr. Ir. Joseph Yamé: CRAN, University of Lorraine, Nancy, France.

Title: Data Driven Fault Tolerant Control: a behavioral approach

Abstract: In this talk we will review our recent work on data-driven fault-tolerant control (FTC) from a behavioral system-theory perspective. We will go through the basics of the mathematical tools of Willems' behavioral system theory and formulate within this framework a control problem as an interconnection of two dynamical systems. Thanks to this fundamental viewpoint on controls and the key concept of behavior, we will address the fault-tolerant control problem when no much a priori information about a plant is available in real-time. Here, we deal simply with the trajectories that are generated by the plant. These trajectories determine the so-called behavior of the plant in various faulty/healthy modes and based on the desired controlled behavior, only those trajectories are selected that obeys certain laws. We will show that the vantage point of the behavioral approach is that the fault-tolerant control problem now becomes completely a real-time model-free or data-driven scheme. We will discuss in this framework two methodologies under the broad classification of FTC systems, namely projection-based approach and online redesign approach. We will also discuss the practical issue of transients management during controller reconfiguration in order to guarantee real-time smooth interconnection between the controller and the unknown faulty plant.

Biography: Dr. Ir. Joseph Yamé received the degree of Doctor in Applied Sciences with the Highest Distinction from the Université Libre de Bruxelles (ULB), Brussels, Belgium in 2001. He previously graduated from Ecole Polytechnique of the ULB in Electrical and Mechanical Engineering with the title of “Ingénieur Civil” and received also the Post-Graduate Engineering degree in Automatic Control. From 2000 to 2005, he was a Research Associate in the Control Engineering and Systems Analysis Department of the ULB, Brussels. In September 2005, he joined the University of Lorraine, Nancy, France, as an Associate Professor in control engineering and computer science. Over the several past years his research activities have focused on different topics in systems theory and advanced control engineering with special interests in dual-adaptive control of stochastic systems, mathematical control theory with an emphasis on sampled-data control and infinite-dimensional discrete-time systems, and the analytical aspects of fuzzy control. During these last years, his research interest has been mainly concentrated on fault tolerant control and control for energy-efficient buildings. He has authored and co-authored over 80 publications, including book contributions, journal and conference papers, and technical reports. He is a member of the Institute of Electrical and Electronics Engineers (IEEE), the American Mathematical Society (AMS), and a senior member of the American Institute of Aeronautics and Astronautics (AIAA).