PREFACE

We are pleased to introduce this special section of the *International Journal of Applied Mathematics and Computer Science*, which is a result of the 7th Workshop on *Advanced Control and Diagnosis* that was held at the University of Zielona Góra, Poland, on 19–20 November 2009, and brought together researchers from all over the world. Almost one hundred speakers had the opportunity to share and discuss their latest results, as well as exchange ideas on new trends in the field of advanced control and diagnosis. Consequently, this special section is devoted to the presentation of the recent and emerging issues in Fault-Tolerant Control (FTC) and Fault Diagnosis (FD).

An unappealing characteristic of all real systems is the fact that they are vulnerable to faults. This explains why there is a continuous need for reliable and the universal FD strategies. This is especially true for engineering systems which are permanently growing due to the inevitable development of modern industry. Indeed, the design and operation of engineering systems require increased attention with respect to reliability, safety and fault tolerance. Thus, it is natural for FD to have become an important subject in modern control theory and practice. This is reflected in the large number of papers on FD in many control-oriented conferences and journals. Indeed, a large amount of knowledge on model-based fault diagnosis has been accumulated through the literature since the beginning of the 1970s. As a result, a wide spectrum of FD techniques has been developed. On the other hand, a suitable interconnection between fault diagnosis and control leads directly to an idea of fault-tolerant control.

In general, FTC systems are classified into two distinct classes: passive and active. In passive FTC, controllers are designed to be robust against a set of presumed faults, therefore there is no need for fault diagnosis, but such a design usually degrades the overall performance. On the other hand, active FTC schemes react to faults actively by reconfiguring control actions, so that the system stability and acceptable performance are maintained. To achieve this, the control system relies on Fault Detection and Isolation (FDI) as well as an accommodation technique. Most of the existing works treat FDI and FTC problems separately. Unfortunately, perfect FDI and fault identification are impossible and hence there is always an inaccuracy related to this process. Thus, there is a need for integrated FDI and FTC schemes for both linear and non-linear systems.

The presented special section is composed of six papers. Most deal with the problem of FD and FTC within a unified framework related to adaptive modelling of reliability, fault monitoring and fault recovery control, fault adaptation with actuator saturation avoidance, reconfigurability analysis as well as active fault-tolerant control. Additionally, one of the papers is related to the robust observer scheme for FDI of non-linear systems, which is usually perceived as an integral part of FTC. It should also be pointed out that the papers contain a large number of examples related to, e.g., a position moored tanker or a cart-pole.

We feel that the papers composing this special section make notable contributions to the state of the art in the field of fault diagnosis and fault-tolerant control. Taking this opportunity we would like to thank the authors for their effort put in the preparation of the final versions of their papers. We are also grateful to the reviewers for their invaluable comments that helped to improve the presentations. Last, but not least, we would like to express our sincere gratitude to Prof. Józef Korbicz, the Editor-in-Chief of *AMCS*, for giving us the opportunity to prepare this special session.

Vicenç Puig
Automatic Control Department
Technical University of Catalonia, Barcelona, Spain

Marcin Witczak
Institute of Control and Computation Engineering
University of Zielona Góra, Poland

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Vicenç Puig was born in 1969, received the telecommunications engineering degree in 1993 and the Ph.D. degree in control engineering in 1999, both from the Technical University of Catalonia (UPC), Barcelona, Spain. He is currently a professor of automatic control and the leader of the Advanced Control Systems (SAC) research group at UPC. His main research interests are fault detection and isolation and fault-tolerant control of dynamic systems. He has been involved in several European projects and networks and has published about 200 papers in international conference proceedings along with about 45 articles in scientific journals.

Marcin Witczak was born in 1973, received the M.Sc. degree in electrical engineering from the University of Zielona Góra, Poland, the Ph.D. degree in automatic control and robotics from the Wrocław University of Technology, Poland, and the D.Sc. degree in electrical engineering from the University of Zielona Góra in 1998, 2002 and 2007, respectively. He has been a professor of automatic control and robotics at the Institute of Control and Computation Engineering, University of Zielona Góra, since 2008. His current research interests include computational intelligence, fault detection and isolation, fault-tolerant control and control theory. He has published more than 80 papers in international journals and conference proceedings and is the author of two monographs as well as 17 book chapters.