Guest Editorial on the Special Section on
Fault Diagnosis and Fault Tolerant Control

This special section of the International Journal of Control, Automation and Systems addresses fault diagnosis, and fault tolerant control, two fields in which research is very active, being motivated by many real life applications (aerospace, power systems, safety critical systems). Faults that occur in sensors and actuators, in process hardware and software components, in human operators' decisions (not even speaking of aggressions), may have catastrophic consequences, not only because nominal specifications are no longer fulfilled, but also because they may result in heavy damage to the operators, the system and the environment.

Fault diagnosis has been the subject of intensive research for more than thirty years, and an extensive corpus of results is now available, starting with the logical theory of diagnosis from the Artificial Intelligence community, the analytical redundancy, diagnosis observers and identification approaches from the Control community, and the decision making approaches from the field of Statistics, to mention only a few. The design of fault tolerant systems, is a more recent field, whose foundations are not yet completely stabilized, but whose understanding is getting deeper and deeper.

Several journals have published special FDI and FTC issues for the last two years, showing the importance of the field. The present issue gathers some of the best international specialists, and addresses the most significant research problems that are currently tackled by the control community : interval-based diagnosis, fast fault identification, inclusion of performance degradation, fault tolerance in non-linear systems...

The first paper is by M. Staroswiecki, who co-authored the recent reference book "Diagnosis and Fault Tolerant Control". It presents an ontology for the Fault Handling problem which includes - but is not limited to - Fault Tolerance. Roughly speaking, an ontology is a description of the concepts, relationships and problems that define a field of research. The presentation given here introduces the reader to the concepts that are important and gives some hints about fundamental questions in Fault Handling.

Two papers address diagnosis issues. The first one is authored by Ph. Planchon and J. Lunze - another co-author of the reference book cited above. It gives a thorough treatment of robust fault diagnosis by means of interval analysis, a technique that originates to the 2000's and is aimed at taking into account uncertainties that are only modelled by the set of the values they may possibly take. The second paper, by K. Zhang, B. Jiang, and V. Cocquempot, addresses the most important issue of identifying a fault model, which is a prerequisite for fault accommodation to take place, by means of an adaptive observer specially designed for fast fault estimation.

Three papers cover very important problems in Fault Tolerant Control : the first one, by Y. Zhang, J. Jiang and D. Theilliol addresses the problem of performance degradation that one must sometimes accept when trying to recover from severe faults like e.g. actuator failures. The second paper, by Y. Wang, D. Zhou, S. J. Qin and H. Wang is concerned with sensor faults in nonlinear systems based on their identifiability, and finally the third paper by N. E. Wu, Y. Guo, K. Huang, M. C. Ruschmann and M. L. Fowler presents a very important application, namely the Fault-Tolerant Tasking and Guidance of an Airborne Location Sensor Network.

We believe that these papers give a very up to date view of the most important problems in the Diagnosis and Fault Tolerance field, and we hope that this special section will encourage researchers and people from industry to develop further theories and applications.

Guest Editors

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