SCHOOL ON DIAGNOSIS OF INDUSTRIAL SYSTEMS AND PROCESSES: THE MODEL-BASED APPROACH

Currently, automated diagnosis of devices is an interesting research and development field. It can be approached with different techniques (knowledge-based systems, case-based reasoning, machine-learning or model-based reasoning) coming from different fields: Control Engineering, Artificial Intelligence or Statistics.

The "School on Diagnosis of industrial systems and processes: the model-based approach" is an intensive seminar which will take place along 9 days in Barcelona, Spain. Its main goal is introducing students to two of the most well-known model-based diagnosis approaches coming from two research communities: Control Engineering known as FDI and Artificial Intelligence known as DX.

The School is open to doctorate students and also to industrials interested in this rather novel approach to diagnosis.

Lessons will be given by national and international experts in the field. In this edition we have two invited speakers: Louise Travé-Massuyès from LAAS-CNRS in Toulouse, France, and Marcel Staroswiecki from LAIL, Lille University, France.

The contents of the school has been divided in 5 thematic blocks which has been scheduled as follows:

T1. Introduction

- T1.1. Definitions: fault, detection, diagnosis, reliability,...
- T1.2. Foundations for fault detection and diagnosis in FDI and DX: detectability, observability, diagnosability
- T.1.3. Where the models come from: Modelling and Identification
- T.1.4. Modelling techniques

T2. Model-based diagnosis: the FDI approach

- T2.1. Structural analysis and analytical redundancy
- T2.2. Model-based detection methods: parameter estimation, parity equations, state observers for linear and non-linear models
- T2.3. Fault detection: Residual evaluation by statistical tests, and envelope generators
- T2.4. Fault isolation structured and directional residuals
- T2.5. Introduction to fault tolerant control
- T2.6. Open problems on FDI: fault estimation, sensor network design for diagnosis, diagnosis on systems with delays

T3. Model-based diagnosis: the DX approach

- T3.1. Qualitative, semi-qualitative and quantitative modelling for DX
- T3.2. Consistency-based diagnosis, CBD: the Reiter's approach
- T3.3. GDE: the computational approach to CBD
- T3.4. Other computational approaches to consistency-based diagnosis
- T3.5. Open problems in CBD: dynamics, fault modes,...

T4. BRIDGE: Integration of FDI and DX approaches

- T4.1. Theoretical links and comparison
- T4.2. Practical comparison and potential synergies

T5. Case Studies and benchmarks

- T5.1. Applications to naval industry
- T5.2. Applications on continuous processes
- T5.3. CHEM benchmark
- T5.4. DAMADICS benchmark and TIGER

Schedule

Mon. 17th	Tues. 18th	Wed. 19th	Thurs. 20th	Frid. 21st	Sat. 22nd	Mon. 24th	Tues. 25th
T1.1 + T1.2	T3.1	T2.1	T2.2	T23 + T2.4	T5.2	T5.3	T4.1
T1.2	T3.2	T2.2	T2.3	T2.4 + T2.5	T5.3	T5.4	T4.2
T1.3 + T1.4	T3.3	T3.4	T2.3	T2.5	(Free)	T5.4	Discussion Panel
T3.1	T5.1	T3.4	T3.5	T3.5	(Free)	T2.6	

Lessons will be given in two sessions: morning (from 9:45 to 13:45) and afternoon (14:45 to 18:45 h).

Location

Facultad de Matemáticas y Estadítica in Campus Sur of Universidad Politécnica de Catalunya (aulas 001 y PC03).
Calle Pau Gargallo 5, Barcelone.

Teachers
Both national and international teachers have been working for several years in the field.

- Louise Travé-Massuyès, from LAAS-CNRS (France) will talk about BRIDGE: Integration of FDI and DX approaches (T4). Louise Travé-Massuyès She is currently a Research Director of the Centre National de Recherche Scientifique (CNRS), working at LAAS, Toulouse, France, in which she has led the "Qualitative Diagnosis, Supervision and Control" Group for several years. Her main research interests are in qualitative and model based reasoning and applications to dynamic systems monitoring and diagnosis. Her current responsibilities include; Co-director of the European Laboratory LEA-SICA; Chairperson of the IEEE SMC Technical Committee on Qualitative Reasoning; member of the IFAC Safeprocess Technical Committee. She is a Senior Member of the IEEE Computer Society. She is also the leader of the MONET2 task group on BRIDGE.
- Marcel Staroswiecki (University of Lille, France) will cover most of the FDI approach (T2). Among other works, Marcel Staroswiecki is co-author of the book "*Diagnosis and Fault-Tolerant Control".* Blanke, M., Kinnaert, M., Lunze, J., Staroswiecki, M. Springer Verlag. 2003.
- Joaquim Armengol (University of Girona, Spain) will Introduce some basic definitions for fault detection and isolation (T1), and will introduce envelope generators for fault detection (T2) (More information about the MICE group from Girona: http://mice.udg.es/)
- Rafael M. Gasca and Carmelo del Valle (University of Seville, Spain) will provide an introduction to qualitative and semi-qualitative modelling for diagnosis (T3) (Additional information on the Quivir group: http://quivir.lsi.us.es:9254/webquivir/jsp/index.jsp)
- Teresa Escobet, Joseba Quevedo and Vicenç Puig (Politechnical University of Catalonia, Spain), will introduce more basic definitions for fault detection (T1), and talk about diagnosis on systems with delays (Information about this group is located in http://webesaii.upc.es/)
- Carlos Alonso and Belarmino Pulido (University of Valladolid, Spain) will introduce the DX approach (T3) (More information about the GSI group can be found in http://www.gsi.infor.uva.es/)
- Finally, different case studies and benchmarks will be presented to illustrate all of those concepts.

REGISTRATION

- The number of students will be limited.
- Registration fee is 360 euro (it includes lunch).
- To obtain additional information please contact:

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Departamento de Informática
Universidad de Valladolid

Vicenç Puig Cayuela
Dept. ESAII
Universidad Politécnica de Cataluña

providing your: name, address, organization, position, telephone, fax and e-mail.

SUPPORT

The Diagnosis School is supported by different institutions:

- MONET2: The European Network of Excellence for Model-based systems and Qualitative Reasoning.
- The Spanish Ministry of Science and Technology (MCyT).
- University of Girona.
- Politechnical University of Catalonia.
- University of Sevilla.
- University of Valladolid.

Additional information can be found in http://www-esaiiterrassa.upc.es/escuela/