

# Model-Based and Data-Driven Fault Detection and Isolation

## Titulaire

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## Mnémonique du cours

MATH-H503

## Langue(s) d'enseignement

Anglais

## Période du cours

Deuxième quadrimestre

## Contenu du cours

### 1. Generation of fault indicators

- Parity space approach to the generation of fault indicators (or residuals)
- Observer-based approach to residual generation

Both methods are developed in a deterministic and in a stochastic framework

### 2. Statistical change detection algorithms for decision system design

- Introduction for statistical process control
- Shewart and exponentially weighted moving average (EWMA) control chart
- Cumulative sum (CUSUM) algorithm and generalized likelihood ratio algorithm

### 3. Change detection based on parameter estimation methods

## Objectifs (et/ou acquis d'apprentissages spécifiques)

To acquire the basic notions on the design of model based systems for fault detection and isolation both for deterministic and stochastic systems

To get acquainted with some classical on-line statistical change detection algorithms and to be able to use them in a decision system

## Méthodes d'enseignement et activités d'apprentissages

Ex cathedra, lectures alternate with implementation of the methods on simple case studies using the MATLAB/SIMULINK software

## Contribution au profil d'enseignement

This teaching unit contributes to the following competences:

- In-depth knowledge and understanding of the advanced methods and theories to schematize and model complex problems or processes
- Reformulate complex engineering problems in order to solve them (simplifying assumptions, reducing complexity)
- Correctly report on research or design results in the form of a technical report or in the form of a scientific paper
- Present and defend results in a scientifically sound way, using contemporary communication tools, for a national as well as for an international professional or lay audience
- Work in an industrial environment with attention to safety, quality assurance, communication and reporting
- Think critically about and evaluate projects, systems and processes, particularly when based on incomplete, contradictory and/or redundant information
- A creative, problem-solving, result-driven and evidence-based attitude, aiming at innovation and applicability in industry and society
- A critical attitude towards one's own results and those of others
- Consciousness of the ethical, social, environmental and economic context of his/her work and strives for sustainable solutions to engineering problems including safety and quality assurance aspects
- The flexibility and adaptability to work in an international and/or intercultural context
- An attitude of life-long learning as needed for the future development of his/her career
- Has an active knowledge of the theory and applications of electronics, information and communication technology, from component up to system level.
- Is able to analyse, specify, design, implement, test and evaluate individual electronic devices, components and algorithms, for signal-processing, communication and complex systems.

## Références, bibliographie et lectures recommandées

- Detection of abrupt changes: theory and application, M. Baseville et Y.V. Nikiforov, Prentice-Hall, Englewood Cliffs, N.Y. (1993).
- System Identification, T. Soderstrom et P. Stoica, Prentice-Hall International, Cambridge, U.K. (1989).
- Diagnosis and fault-Tolerant control, M. Blanke; M. Kinnaert; J. Lunze et M. Staroswiecki, Springer, Berlin, 3rd Ed. (2015).

## Autres renseignements

### Contact(s)

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## Méthode(s) d'évaluation

Examen oral

## Méthode(s) d'évaluation (complément)

Oral examination

## Construction de la note (en ce compris, la pondération des notes partielles)

Report on the laboratory work : 50%; oral examination: 50%

## Langue(s) d'évaluation principale(s)

Anglais

## Programmes

### Programmes proposant ce cours à l'école polytechnique de Bruxelles

MA-IRCB | **Master : ingénieur civil biomédical** | finalité Spécialisée/ bloc 2, MA-IREL | **Master : ingénieur civil électricien** | finalité Spécialisée électronique et technologies de l'information/bloc 2 **et** MA-IREM | **Master : ingénieur civil électromécanicien** | finalité Spécialisée/bloc 2 et finalité Operation engineering and management/ bloc 2

