

# Fault-tolerant systems - course description

General information	
Course name	Fault-tolerant systems
Course ID	06.0-AutD-SterTolerUszkod-Er
Faculty	<a href="#">Faculty of Computer Science, Electrical Engineering and Automatics</a>
Field of study	Automatic Control and Robotics / Computer Control Systems
Education profile	academic
Level of studies	Second-cycle Erasmus programme
Beginning semester	winter term 2022/2023

Course information	
Semester	2
ECTS credits to win	4
Course type	optional
Teaching language	english
Author of syllabus	<ul style="list-style-type: none"><li>prof. dr hab. inż. Marcin Witczak</li></ul>

Classes forms					
The class form	Hours per semester (full-time)	Hours per week (full-time)	Hours per semester (part-time)	Hours per week (part-time)	Form of assignment
Laboratory	30	2	-	-	Credit with grade
Lecture	15	1	-	-	Credit with grade

## Aim of the course

Introduction to modern control systems affected by disturbances and faults.

Detailed objectives:

- 1) Introduction to actuator and sensor fault estimation
- 2) Introduction to fault-tolerant control
- 3) Integration of fault estimation and fault-tolerant control

## Prerequisites

Essential calculus and linear algebra

## Scope

Essential definitions of fault diagnosis: analytical and hardware redundancy, fault detection, isolation and identification. Classical fault detection techniques: parameter estimation, parity relation and state observers. Actuator and sensor fault estimation. Passive and active fault-tolerant control. Fault-tolerant control = fusion of control and diagnostics: passive and active solutions. Integration of fault estimation and fault tolerant control. Essential solutions used in fault-tolerant control. Application examples.

## Teaching methods

Problem based lecture, classical lecture.

## Learning outcomes and methods of their verification

Outcome description	Outcome symbols	Methods of verification	The class form
Skills of describing essential fault-tolerant control schemes		<ul style="list-style-type: none"><li>a preparation of a project</li><li>an evaluation test</li><li>an exam - oral, descriptive, test and other</li></ul>	<ul style="list-style-type: none"><li>Lecture</li><li>Laboratory</li></ul>
Knowledge and skills concerning design and implementation of fault estimation schemes.		<ul style="list-style-type: none"><li>a preparation of a project</li><li>an evaluation test</li><li>an exam - oral, descriptive, test and other</li></ul>	<ul style="list-style-type: none"><li>Lecture</li><li>Laboratory</li></ul>
Skills in indicating the possibility of coupling fault diagnosis and control schemes		<ul style="list-style-type: none"><li>a preparation of a project</li><li>an evaluation test</li><li>an exam - oral, descriptive, test and other</li></ul>	<ul style="list-style-type: none"><li>Lecture</li><li>Laboratory</li></ul>
Knowledge about essential fault diagnosis features		<ul style="list-style-type: none"><li>a preparation of a project</li><li>an evaluation test</li><li>an exam - oral, descriptive, test and other</li></ul>	<ul style="list-style-type: none"><li>Lecture</li><li>Laboratory</li></ul>

# Assignment conditions

Lecture - positive scores concerning an exam

Lab - positive scores concerning a written test as well as all laboratory project tasks

## Recommended reading

1. Diagnostyka procesów. Modele, metody sztucznej inteligencji, zastosowania. Red: Korbicz J., Kościelny J.M., Kowalczyk Z., Cholewa W. -Wydawnictwo Naukowo-Techniczne, Warszawa, 2002. 2. Kościelny J.M.: Diagnostyka zautomatyzowanych procesów przemysłowych. - Akademicka Oficyna Wydawnicza EXIT, Warszawa, 2001. 3. Witczak M.: Modelling and estimation strategies for fault diagnosis of non-linear systems. – Berlin: Springer, 2007 4. Witczak M.: Fault diagnosis and fault-tolerant control strategies for non-linear systems. – Berlin: Springer, 2013

## Further reading

## Notes

Modified by dr hab. inż. Wojciech Paszke, prof. UZ (last modification: 11-04-2022 09:05)

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