Diagnostics of industrial processes - course description

General information

Course name	Diagnostics of industrial processes
Course ID	06.0-WE-AutP-DiagIndusProc-Er
Faculty	Faculty of Computer Science, Electrical Engineering and Automatics
Field of study	Automatic Control and Robotics
Education profile	academic
Level of studies	First-cycle Erasmus programme
Beginning semester	winter term 2019/2020

Course information

Semester	5
ECTS credits to win	4
Course type	obligatory
Teaching language	english
Author of syllabus	• prof. dr hab. inż. Józef Korbicz

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
Lecture	30	2	-	-	Exam
Laboratory	30	2	-	-	Credit with grade

Aim of the course

- familiarize students with basic fault detection and localization methods
- increasing skills in the design of diagnostic systems for industrial applications
- acquire the ability to choose the appropriate diagnostic method for the conditions of the industrial plant

Prerequisites

Control engineering, Discrete process control

Scope

Introduction to diagnostics of the processes. Basic tasks, basic concepts, diagnostic objectives, diagnostic systems concepts, classification of fault detection methods and localization. Models in process diagnostics.

Fault detection: physical equations, linear state equations, state observers (Kalman and Luenberger filters), linear object transmitters, neural models, fuzzy models.

Fault localization: binary diagnostic matrix, diagnostic tree and graphs, rules and logic functions. Verification of credibility. Signal analysis methods. Analysis of statistical signal parameters, spectral analysis.

Analytical detection methods. Analytical redundancy. Generate residues using: linear object transmission, conformal equations, object state equations, state observers, process model parameter identifiers.

Intelligent computing in fault detection systems. Neural models: multilayer perceptron, recursive networks, GMDH networks. Fuzzy models: Wang and Mendel type, fuzzy neural networks - Takagi-Sugeno-Kang (TSK).

Banks of observers. The concept of observers bank with unknown inputs, robust banks of observers.

Industrial applications: Fault diagnosis in a sugar evaporation station: fault detection and localization of the evaporator.

Teaching methods

Lecture: conventional lecture

Laboratory: laboratory exercises

Learning outcomes and methods of theirs verification

Outcome description	Outcome symbols	Methods of verification	The class form
Student can choose and characterize basic diagnostic methods. Student is able to identify the required diagnostic scheme for the specific purpose.		• an exam - oral, descriptive, test and other	• Lecture
Student can plan and conduct an experiment to confirm the effectiveness of the proposed industrial process diagnostic system.		• a quiz • activity during the classes	• Laboratory

Outcome description	Outcomesymbols	Methods of verification	The class form
Student is able to work in a team and communicate in a team.		• a quiz • activity during the classes	• Laboratory
Student is able to design the required diagnostic system.		• a quiz • activity during the classes	• Laboratory

Assignment conditions

Lecture - the pass condition of the course is to obtain a positive assessment from a written or oral exams.

Laboratory - the pass condition is to obtain positive grades from all laboratory exercises, intended to be implemented within the laboratory program

Components of the final grade = lecture: 50% + laboratory: 50%

Recommended reading

1. Korbicz J., Kościelny J.M., Kowalczuk Z., Cholewa W. (red.): Diagnostyka procesów. Modele, Metody Sztucznej Inteligencji, Zastosowania, Wydawnictwa NaukowoTechniczne, Warszawa, 2002

2. Kościelny J.M.: Diagnostyka zautomatyzowanych procesów przemysłowych, Akademicka Oficyna Wydawnicza EXIT, Warszawa, 2001

3. Kowalczuk Z., Wiszniewski B (red.): Inteligentne wydobywanie informacji w celach diagnostycznych, Pomorskie Wydawnictwo Naukowo-Techniczne, Gdańsk, 2007

4. Pieczyński A.: Reprezentacja wiedzy w diagnostycznym systemie ekspertowym, Lubuskie Towarzystwo Naukowe, Zielona Góra, 2003

5. Basztura Cz.: Komputerowe systemy diagnostyki akustycznej, Wydawnictwo Naukowe, PWN, Warszawa, 1996

Further reading

Each time given by the teacher.

Notes

Modified by dr hab. inż. Wojciech Paszke, prof. UZ (last modification: 05-05-2020 14:21)