Intelligent control methods - course description

General information

Course name	Intelligent control methods
Course ID	11.9-WE-AutD-IntelConMeth.-Er
Faculty	Faculty of Computer Science, Electrical Engineering and Automatics
Field of study	Automatic Control and Robotics / Computer Control Systems
Education profile	academic
Level of studies	Second-cycle Erasmus programme
Beginning semester	winter term 2020/2021

Course information

Semester	2
ECTS credits to win	5
Course type	obligatory
Teaching language	english
Author of syllabus	• prof. dr hab. inż. Marcin Witczak

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

Introduction to artificial neural networks and fuzzy logic.

Shaping skills in design fuzzy and neural network-based control systems

Prerequisites

Control theory

Scope

Introduction to neural networks: properties, essential topologies and connections, learning methods, application perspectives in control engineering and robotics.

Multilayer feedforward networks: design of an essential processing unit. Network structures and working rules, backpropagation algorithm and its modifications, knowledge generalization, regularization. Neural networks in classification tasks. Dynamic neural networks: feedforward networks with delay, recurrent networks (Williams-Zipser network), partially recurrent network (Elman network). Serial and parallel models in system identification. Essential control structures using neural networks.

Introduction to fuzzy logic: fuzzy sets, fuzzification and defazification. Rule base and its generation. Fuzzy inference models: Mamdani and Takagi-Sugeno. Design of Takagi-Sugeno models. Design of fuzzy PID. State feedback controller with Takagi-Sugeno models.

Teaching methods

Lecture: conventional lecture
Lab: laboratory exercises

Learning outcomes and methods of theirs verification

Outcome description	Outcome symbols	Methods of verification	The class form
Can design modern control systems with neural networks and fuzzy logic		• a quiz	• Laboratory
Understands the dynamical development of the field		• an exam - oral, descriptive, test and other	• Lecture
Understands the rules governing neural networks and fuzzy logic. Understands that they should be applied in cases when classical methods do not provide expected results.		• an exam - oral, descriptive, test and other	• Lecture

Assignment conditions

Lecture - positive score of a written exam
Lab – positive scores concerning all laboratory tasks
Final score composition = Lecture: 50% + Lab: 50%

Recommended reading

1. Korbicz, A. Obuchowicz, D. Uciński D., Sieci neuronowe. Podstawy i zastosowania, Akademicka Oficyna Wydawnicza, PLJ, Warszawa, 1994
2. R. Rojek, K. Bartecki, J. Korniak, Zastosowanie sztucznych sieci neuronowych i logiki rozmytej w automatyce, Oficyna Wydawnicza Politechniki Opolskiej, Opole, 2000
3. R.R. Yager, D.P. Filev, Podstawy modelowania i sterowania rozmytego, WNT, Warszawa, 1995
4. M. Noorgard, O. Ravn, N.M. Poulsen, L.K. Hansen, Neural networks for Modelling and Control of Dynamic Systems, Springer-Verlag, Londyn, 2000

Further reading

Notes

Modified by prof. dr hab. inż. Marcin Witczak (last modification: 29-04-2020 13:35)