

Course name: Artificial intelligence in control applications		
Field of study: Computer science	Type of study: Full-time	Source code: CIDM2_02
Course characteristics: Mandatory within the additional content	Level: Second (M.Sc.)	Year: II Semester: IV
Type of classes: lectures, laboratories, exercises	Hours per week: 2 lect, 2 lab, 1 ex	ECTS points amount: 5 ECTS

COURSE GUIDE

I. GENERAL INFORMATION OF THE COURSE

AIMS OF THE COURSE

- A1. To introduce students into implementation of artificial intelligence tools in control application issues. To do this some overview of selected components of artificial intelligence will be presented in terms of their usefulness in typical applications in control systems.
- A2. To obtain knowledge and practical skills in designing, running and testing examples of control systems using components of artificial intelligence.

PRELIMINARY REQUIREMENTS FOR THE KNOWLEDGE, SKILLS AND OTHER COMPETENCIES

1. Knowledge of mathematics, artificial intelligence and control systems
2. Basic knowledge and skills in computer programming.
3. Ability of using different sources of information and technical documentation.
4. Ability of working alone and in the group.
5. Ability of correct interpretation and presentation of his/her own activity.

II. EFFECTS OF EDUCATION

- EK 1 – Students have basic knowledge how to use artificial intelligence components in control systems.
- EK 2 – Students are able to use suitable artificial intelligence components to implement in selected control system applications
- EK 3 – Students are able to prepare report describing implemented application.

PROGRAM OF EDUCATION

Lectures	Hours
Lect. 1 General aspects of using artificial intelligence methods in control systems	2
Lect. 2 Conventional function approximators with artificial neural networks, fuzzy sets and fuzzy-neural networks	2
Lect. 3 Application of artificial neural networks in control systems	2
Lect. 4 Application of artificial neural networks in control systems cont.	2
Lect. 5 Fuzzy sets systems	2
Lect. 6 Fuzzy sets systems cont.	2
Lect. 7 Fuzzy-neural systems	2

Lect. 8	Genetic algorithms	2
Lect. 9	Controlled device state variable estimators with artificial intelligence tools	2
Lect. 10	Examples of control system components implementation with artificial neural networks	2
Lect. 11	Examples of control system components implementation with artificial neural networks cont.	2
Lect. 12	Neurocontrol	2
Lect. 13	Neurocontrol cont.	2
Lect. 14	Fuzzy controllers	2
Lect. 15	Fuzzy controllers cont.	2
Laboratories		Hours
Lab. 1	Introduction to the Matlab-Simulink environment	2
Lab. 2	Using the Model Reference Controller Block	2
Lab. 3	Using the Model Reference Controller Block cont.	2
Lab. 4	Using the NARMA-L2 Controller Block	2
Lab. 5	Using the NARMA-L2 Controller Block cont.	2
Lab. 6	Using the NN Predictive Controller Block	2
Lab. 7	Using the NN Predictive Controller Block cont.	2
Lab. 8	Fuzzy Logic Controller	2
Lab. 9	Fuzzy Logic Controller cont.	2
Lab. 10	Example of using the Fuzzy Logic Controller	2
Lab. 11	Example of using the Fuzzy Logic Controller cont.	2
Lab. 12	Fuzzy Logic Controller with Ruleviewer	2
Lab. 13	Fuzzy Logic Controller with Ruleviewer cont.	2
Lab. 14	Example of using the Fuzzy Logic Controller with Ruleviewer	2
Lab. 15	Example of using the Fuzzy Logic Controller with Ruleviewer cont.	2
Exercises		Hours
Ex. 1	Conventional function approximators with artificial neural networks, fuzzy sets and fuzzy-neural networks	1
Ex. 2	Conventional function approximators with artificial neural networks, fuzzy sets and fuzzy-neural networks cont.	1
Ex. 3	Fuzzy sets systems	1
Ex. 4	Fuzzy sets systems cont.	1
Ex. 5	Fuzzy-neural systems	1
Ex. 6	Fuzzy-neural systems cont.	1
Ex. 7	Genetic algorithms	1
Ex. 8	Genetic algorithms cont.	1
Ex. 9	State variable estimators with artificial intelligence tools	1
Ex. 10	State variable estimators with artificial intelligence tools cont.	1
Ex. 11	Neurocontrol	1
Ex. 12	Neurocontrol cont.	1
Ex. 13	Fuzzy controllers	1
Ex. 14	Fuzzy controllers cont.	1
Ex. 15	Fuzzy controllers cont.	1

DIDACTIC TOOLS

1. – lectures using multimedia presentations
2. – blackboard and chalk or whiteboards and pens
3. – laboratory guides
4. – reports from laboratory activities

5. – computer stations with software

BASIC AND ADDITIONAL LITERATURE

1. Rutkowski L.: Metody i techniki sztucznej inteligencji, PWN, Warszawa 2005

2. Piegat A.: Modelowanie i sterowanie rozmyte, Exit, Warszawa 1999

4. Vas P.: Artificial-Intelligence-Based Electrical Machines and Drives, Oxford University Press, 1999

TEACHER

1. dr inż. Jerzy Jelonkiewicz, jerzy.jelonkiewicz@iisi.pcz.pl