inf303 - Fuzzy Control and Artificial Neural Networks in Robotics and Automation

Module label
Fuzzy Control and Artificial Neural Networks in Robotics and Automation

Module code
inf303

Credit points
6.0 KP

Workload
180 h

Used in course of study
- Master's Programme Computing Science > Angewandte Informatik
- Master's Programme Computing Science > Technische Informatik
- Master's Programme Embedded Systems and Microrobotics > Akzentsetzungsmodule
- Master's Programme Engineering of Socio-Technical Systems > Embedded Brain Computer Interaction
- Master's Programme Engineering of Socio-Technical Systems > Human-Computer Interaction
- Master's Programme Engineering of Socio-Technical Systems > Systems Engineering
- Master's Programme Engineering Physics > Schwerpunkt: Renewable Energies

Contact person
Module responsibility
- Sergei Fatikow
- Die im Modul Lehrenden

Authorized examiners
- Sergei Fatikow
- Die im Modul Lehrenden

Entry requirements
Experts in different branches try to approach their application-specific control and information processing problems by using fuzzy logic and artificial neural networks (ANN). The experiences gathered up to now prove robotics and automation technology to be predestined fields of application of both these approaches. The major topics of the course are control problems in robotics and automation technology, principles of fuzzy logic and ANN and their practical applications, comparison of conventional and advanced control methods, combination of fuzzy logic and ANN in control systems. The course gives a comprehensive treatment of these advanced approaches for interested students.

Professional competence
The students:
- recognise control problems in robotics and automation technology,
- name principles of fuzzy logic and ANN and their practical applications,
- compare conventional and advanced control methods,
- characterise the combination of fuzzy logic and ANN in control systems

Methodological competence
The students:
- will acquire knowledge of the tools, methods and applications in fuzzy logic and ANN
- deepen their knowledge for the practical use of the given methods
- can use common software tools for design and application of fuzzy logic and ANN

Social competence
The students:
- gain experience in interdisciplinary work
- are integrated into the recent research work

Objective of the module / skills:
Self-competence
The students:
- are able to transfer the gained knowledge for later use in their theses or studies for AMiR
- can Design (complex) fuzzy logic controller and ANN systems
reflect their (control) solutions by using methods learned in this course

Module contents

- Control problems in robotics and automation technology
- Basic ideas of fuzzy logic and ANN
- Principles of fuzzy logic
- Fuzzy logic of rule-based systems
- ANN models
- ANN learning rules
- Multilayer perceptron networks and backpropagation
- Associative networks
- Self-organizing feature maps
- PID design principles
- Design of fuzzy control systems
- Fuzzy logic application examples
- Design of ANN control systems
- ANN application examples
- Fuzzy + Neuro: principles and applications

Reader’s advisory

Essential:

- Lecture notes (available at the secretariat, A1-3-303) in book form

Recommended:


Secondary Literature:

- Altrock, M. O. R.: Fuzzy Logic, R. Oldenbourg Verlag, 1993
- Kahlert, J. und Hubert, F.: Fuzzy-Logik und Fuzzy-Control, Vieweg, 1993
- Krampr, K.P.: Neuronale Netze, Carl Hanser, 1993
- Lawrence, J.: Neuronale Netze, Syntehma Verlag, München, 1992
- Patterson, D.W.: Künstliche neuronale Netze, Prentice Hall, 1996
- Pham, D.T. a200
- Schulte, U.: Einführung in Fuzzy-Logik, Franzis-Verlag, München, 1993
- Zimmermann H.-J. (Hrsg.): Datenanalyse, VDI-Verlag, 1995
- Zimmermann, H.-J. (Hrsg.): Neuro + Fuzzy: Technologien und Anwendungen, VDI-Verlag,
1995

Links
Languages of instruction: German, English
Duration (semesters): 1 Semester
Module frequency: once a year
Module capacity: unlimited
Module level: AS (Akzentsetzung / Accentuation)
Module type: Pflicht o. Wahlpflicht / compulsory or optional
Lern-/Lehrform / Type of program: V+Ü
Vorkenntnisse / Previous knowledge: Control engineering

Examination
Final exam of module: At the end of the lecture period until the beginning of the next semester
Type of examination: Hands-on-exercises and oral Exam

Course type Comment SWS Frequency Workload attendance
Lecture 3.00 SuSe 42 h
Exercises 1.00 SuSe 14 h

Total time of attendance for the module: 56 h