Syrian Arab Republic

Higher Institute for Applied Sciences and Technology

Course Specification Document

Title	Advanced Control

Credits	3.5 ECTS

Aims	This course aims to provide the student with knowledge specific to the analysis and design of control systems using Fuzzy logic and to the design of adaptive controllers. It also introduces him to neural networks.

Intended learning outcomes

On successful completion of this course, the student will be able to:

- Understand fuzzy logic and operations on fuzzy sets.
- Recognize the methods of estimating nonlinear functions using fuzzy logic.
- Recognize adaptive control methods.
- Recognize the structure of neural networks and how they work.
- Use fuzzy logic to analyze the behavior of dynamic systems.
- Complete mathematical models using the computer to obtain operational models.
- Implement a neural network using MATLAB.

Syllabus

- **Fuzzy Sets and basic operations on them:** Fuzzy sets and membership functions, properties of fuzzy sets, operation on fuzzy sets.
- **Linguistic variables:** Linguistic variables, fuzzy IF-THEN rules.
- **Fuzzy systems components**: Fuzzy rule base, fuzzy inference engine, fuzzifiers and defuzzifiers.
- **Fuzzy systems as** nonlinear mappings.
- **Basic concepts in adaptive control:** What is adaptive control, when to use adaptive control.
- **Self-tuning adaptive controllers (STR):** Design method for minimum-phase systems, design method for non-minimum-phase systems.
- **Model Reference Adaptive Control (MARC):** Adaptive control for first-order systems, adaptive control for second-order systems, using the MIT rule, using Lyapunov's theory.
- **Gain scheduling for adaptive controllers design.**
- **Neural Networks:** Neuron structure, neural network structure, types of neural networks, learning methods.