NASA/ARC Proposed Training In Intelligent Control

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Workshop on Fuzzy Control Systems
and Space Station Applications, Nov. 14-15, 1990
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Outline

1- General courses:

  - Intelligent Control:

    - Fuzzy Logic in Control

    - Neural Networks in Control

    - Artificial Intelligence in control

    - Hybrid Approaches

  - Uncertainty Management in Artificial Intelligence

2- Hands on Experience

  - Experiments with robot arm (simulated and real hardware)

  - Cart-pole Balancing

3- Ames Associate Programs

  - Spending time at Ames

4- Collaborative work on development of fuzzy controllers

Intelligent Control Course
(Fuzzy Logic Control)

- The basics of Fuzzy Set Theory

- Fuzzy Sets Operations

- Architecture of Fuzzy Logic Controllers

    - Coding the inputs

    - Setting up the control knowledge base

    - Conflict resolution and decision making

    - Decoding the outputs

- Successful applications

    - Lab Prototypes

    - Commercial applications

- Advantages and disadvantages

Intelligent Control Course
(Neurocontrol)

- The basics of artificial neural networks
- Artificial Neural Networks:
    - Interactive Activation Model
    - General Error Back-Propagation Method
    - ADALINE and LMS Algorithm
    - Cerebellar Model Arithmetic Computer (CMAC)   Model
    - Competitive Learning Models
- Advantages and disadvantages of Neurocontrol
- Applications

Intelligent Control Course
(AI-based Approaches)

- The basics of Qualitative Reasoning
- The basics of rule-based control
- Applications
- Advantages and Disadvantages

Intelligent Control Course
(Hybrid Approaches)

- NeuroFuzzy Control
    - Competitive Learning
    - Fuzzy Control with reinforcement learning
- Hierarchical control models
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Hands on Experience

- Control experiments with

    - A simulated model of the robotics arm

    - The PUMA robot

    - A simulated model of the cart-pole balancing

    - The laboratory cart-pole balancing hardware system

    - The rendezvous-docking simulator for the Space Shuttle

- Computing facilities to use the fuzzy computer chips

    - interfaced with a SUN work station

Ames Associate Program

- Interested participants can spend time at Ames
    - Have to donate their time
- Can utilize the Ames facilities
- From two months to a year

Issues for the Panel Discussion

- Is Fuzzy Logic Control appropriate for this domain?

    - Does an analytical mathematical model exist for this problem or can it be developed within a reasonable time?

    - Who are the experts in this domain? how can their knowledge be modeled?

- What steps (beyond the general methodology) have to be taken in order to develop a fuzzy logic controller for this problem?

- How important are the stability issues? how can we validate the controller?