NASA/ARC Proposed Training in Intelligent Control

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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
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?