

Laboratory Projects in Intelligent Control

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A few ideas for laboratory projects from some of the main popular areas of intelligent control are provided below:

Fuzzy Control: Design a fuzzy controller for a plant in the laboratory that exhibits strong nonlinear behavior. Explain, using the physics of the plant, why the rules you choose make sense. Implement the fuzzy controller. Evaluate its ability to perform disturbance rejection. Develop a nonlinear controller for the plant based on the use of a mathematical model of the plant (e.g., one based on feedback linearization methods). Implement this controller. Compare with the fuzzy controller, for both nominal and plant change conditions. To get a flavor for the type of comparative analysis you should do, see [1]. Candidate plants include the cube and helicopter.

Planning Systems: Develop a planning system approach to control of a plant in the lab. This could be standard linear model predictive control approach, or a more sophisticated planning strategy from [2]. A good candidate plant may be the tanks.

Learning Systems and Adaptive Estimation and Control: Develop an on-line approximation based adaptive controller or estimator and implement it in the lab. Compare its performance to a conventional adaptive method. You should consider the adaptive strategies in [3], and the methodology there for comparative analyses. Candidate plants include most of the experiments in the laboratory.

Evolution: Develop a genetic adaptive controller, implement it, and evaluate its performance in relation to other control strategies. See [2] for background on how to develop such a controller. Candidate plants include most of the experiments in the laboratory.

[1] Kevin M. Passino and Stephen Yurkovich, *Fuzzy Control*, Addison Wesley Longman, Menlo Park, CA, 1998. Available for a free download from the web and K. Passino's web site.

[2] K.M. Passino, *Biomimicry for Optimization, Control, and Automation*, Springer-Verlag, London, UK, 2004.

[3] Jeffrey T. Spooner, Manfredi Maggiore, Raul Ordonez, and Kevin M. Passino, *Stable Adaptive Control and Estimation for Nonlinear Systems: Neural and Fuzzy Approximator Techniques*, John Wiley and Sons, NY, 2002.