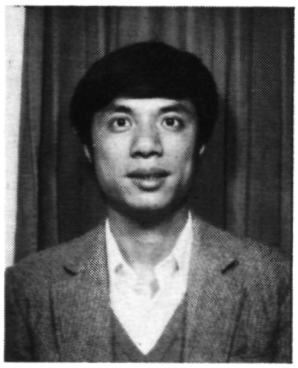

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FUZZY CONTROL THEORY: A NONLINEAR CASE

Abstract

We prove theoretically that a nonlinear fuzzy controller is a nonfuzzy proportional-integral-derivative (PID) controller with proportional gain, integral constant, and derivative constant changing with error, rate change of error, and rate change of error rate about a setpoint of a process. The nonlinear fuzzy controller consists of the following parts:

1. The linear defuzzification algorithm

2. The linear fuzzy control rules

3. Zadeh's AND and OR fuzzy logics for evaluating the fuzzy control rules

4. The nonlinear defuzzification algorithm

The nonlinear fuzzy controller is a linear fuzzy controller which is precisely equivalent to a nonfuzzy PID controller if the linear defuzzification algorithm is used instead of the nonlinear one listed above.

The results of computer simulation reveal that the control performances of the nonlinear fuzzy controller and a nonfuzzy PID controller are almost the same if a linear process is controlled. However, the nonlinear fuzzy controller can control some nonlinear processes much better than a nonfuzzy PID controller does.