



FUZZY CONTROL FOR PNEUMATIC MUSCLE TRACKING VIA EVOLUTIONARY TUNING

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ABSTRACT—This paper studies the evolutionary design of a fuzzy P+ID controller for an actual pneumatic muscle actuator system. The control of pneumatic muscles is a challenging problem because of their high degree of nonlinearity, time-varying parameters, and uncertainty. A fuzzy P+ID controller is constructed using an incremental fuzzy logic controller in place of the proportional term in a conventional PID controller. Several controller parameters are optimized via an evolutionary algorithm. The optimization is performed using a recurrent neuro-fuzzy dynamic model of the muscle rather than the muscle itself. Control results are presented, where the control objective is to force muscle length to follow a reference signal under a load. After evolutionary design, excellent tracking performance is obtained with the real muscle without the need for further tuning of controller parameters. The tracking performance is compared to that of another fuzzy controller.

Key Words: Fuzzy control, evolutionary algorithms, neurofuzzy modeling, pneumatic actuators