



SELF-TUNING FUZZY SPEED CONTROLLER OF TRAVELLING WAVE ULTRASONIC MOTOR

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Abstract- Aiming at the nonlinear characteristic of ultrasonic motor, some control strategies have been proposed to control the rotating speed of ultrasonic motor. But most of these strategies are too complex to realize using a low-cost embedded device. In this paper, a simple fuzzy speed controller is designed for ultrasonic motor. Until now, there has no mature and theoretic design method of fuzzy controller. Therefore, experience of expert is often used as the base of design. It makes the design of fuzzy controller become a sophisticated task. In this paper, the design method of fuzzy controller based on fuzzy model is described in detail. Rules of the fuzzy controller are optimized offline using ant colony optimization, and the appropriate parameters of fuzzy controller are also ascertained during the process of optimization. The designed controller is used to control the rotating speed of traveling wave ultrasonic motor with the type of USR60. According to the difference between the actual responses with different speed references, a kind of online tuning method is proposed to modulate the proportional coefficient of fuzzy control. Experiments indicate the validity of the proposed fuzzy controller.

Index terms: ultrasonic motor, speed control, fuzzy, ant colony optimization