IMPERIALIST COMPETITIVE ALGORITHM-BASED FUZZY PID CONTROL METHODOLOGY FOR SPEED TRACKING ENHANCEMENT OF STEPPER MOTOR

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ABSTRACT- *Precise control of the stepper motor has always been a topic of interest and also a challenging issue among control engineering researchers due to the nonlinear nature of the motor dynamic. Abrupt influences of the uncertainties on the model's dynamic and control performance, on the other hand, must be taken into account for providing a control methodology including the characteristics of adaption and flexibility. Lack of these items in most of the classic control approaches results in degradation of the control action. The main purpose of this paper is to provide an intelligent approach for improving the functionality of conventional PID controller in the problem of trajectory tracking in permanent magnet stepper motor (PMSM). Combination of a meta-heuristic algorithm called imperialist competitive algorithm (ICA) and fuzzy logic is employed for online tuning of PID controller. This, consequently, establishes an intelligent structure, fuzzy-PID controller (FPID), which is more flexible and accurate both in certain and uncertain situations. Using a systematic approach in designing the optimal fuzzy structure based on the ICA is our contribution here which leads to better performance of PMSM. Comparing the results of simulations, done in Matlab Simulink, between the suggested control strategy and performance of the PID, expresses the remarkable capability of FPID in overcoming the complexity of control of the nonlinear and uncertain systems.*

Index terms: PMSM, trajectory tracking, ICA, FPID controller, perturbation