PRZEGL?D ELEKTROTECHNICZNY

Volume 48, Issue 12, 2020, Pages 40-46

Particle Swarm Optimization of Fuzzy Fractional PDμ+I Controllerof a PMDC Motor for Reliable Operation of Wire-Feeder Units ofGMAW Welding Machine

N. Hamouda, B. Babes, S. Kahla, C. HAMOUDA, A. Boutaghane

Abstract: In this article, we consider the development of an optimal control approach based on fuzzy fractional PDμ+I controller to improve thespeed error-tracking and control capability of a permanent magnet DC Motor (PMDC) driven wire-feeder systems (WFSs) of gas metal arc welding(GMAW) process. The proposed controller employs an optimized fractional-order proportional derivative + integral (PDμ+I) controller that serves toeliminate oscillations, overshoots, undershoots and steady state fluctuations of the PMDC motor and makes the wire-feeder unit (WFU) has fast andstable starting process as well as excellent dynamic characteristics. The fixed controller parameters are meta-heuristically selected via a particleswarm optimization (PSO) algorithm. Numerical simulations are performed in MATLAB/SIMULINK environment and the performance of the proposedfuzzy fractional PDμ+I controller is validated. The simulation tests clearly demonstrate the significant improvement rendered by the proposed fuzzyPDμ+I controller in the wire-feeder system's reference tracking performance, torque disturbance rejection capability and robustness against modeluncertainties.

Keywords : GMAW process, Wire-feeder System (WFS), fuzzy fractional PDμ+I controller, Particle Swarm Optimization (PSO) algorithm