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Velocity Control for Spherical Robot using PI-Fuzzy Logic (Conference Paper)

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Abstract

This paper presents the finding on designing the fuzzy logic controller and analysis of the step input test on the model and control design. The PI-type fuzzy logic controller (FLC) was designed to control the velocity of the rolling spherical robot. The spherical robot model was tested with step input signal to analysis the effectiveness of the designed Fuzzy logic controller with 25-membership rule being constructed in Fuzzy toolbox MATLAB using triangular membership function and combination of gaussian and sigmoidal membership function. The output scaling factor (output gain) of FLC was tuned using Response Optimization toolbox and Particle Swarm Optimization to improve the system performance. Optimization using Matlab toolbox is done by specified the desired step response characteristics while in PSO, minimizing the Integral Absolute Error (IAE) is used as on objective of the optimization. The combined membership function shows better performance with less 8% overshoot, rise time less than 2s and settle at less than 3s after the response optimization process. Meanwhile, the PSO manage to tune the gain to reduce the IAE but contain large overshoot and longer settling time. © 2019 IEEE.

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