Intelligent Control of Twin-Rotor MIMO System Using Fuzzy Inference Techniques.

ABSTRACT

The flight control system of helicopter is difficult to control for their performance of high-order unstable, nonlinear, and multiple-inputs multiple-outputs (MIMO) system. The behavior of two degree-of-freedom (2-DOF) helicopter has significant cross-coupling between pitch and yaw directional motions. This study presents a control system for a 2-DOF helicopter plant which more specific presented as twin-rotor MIMO system by using fuzzy logic technique. Fuzzy logic controller (FLC) is designed by using MATLAB to improve the performance of flight control system. Thus, the designed pitch and yaw controller are tuned by adjusting the range of membership function of input variable and the number of fuzzy rules used. The designed FLC are implemented and the results of the simulation are compared with LQR controller. The proposed pitch fuzzy controller shows improvement in rise time from 0.607sec to 0.458s, settling time from 7.188s to 1.866s, and percent overshoot from 38.1% to 0% over the existing pitch LQR controller. Meanwhile, the proposed yaw fuzzy controller shows improvement in rise time from 1.361s to 0.828s, settling time from 9.120sec to 2.517 s, and percent overshoot from 23.51% to 2.86% over the existing yaw LQR controller. Hence, the simulation results show that FLC has great potential than LQR controller for the flight control system.

Keyword: Twin-Rotor MIMO System, Fuzzy Logic Controller, LQR Controller, Pitch and Yaw Control