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Optimal Tuning of Linear Quadratic Regulator Controller Using a Particle Swarm Optimization for Two-Rotor Aerodynamical System

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Abstract : This paper presents an optimal state feedback controller based on Linear Quadratic Regulator (LQR) for a two-rotor aero-dynamical system (TRAS). TRAS is a highly nonlinear multi-input multi-output (MIMO) system with two degrees of freedom and cross coupling. There are two parameters that define the behavior of LQR controller: state weighting matrix and control weighting matrix. The two parameters influence the performance of LQR. Particle Swarm Optimization (PSO) is proposed to optimally tune weighting matrices of LQR. The major concern of using LQR controller is to stabilize the TRAS by making the beam move quickly and accurately for tracking a trajectory or to reach a desired altitude. The simulation results were carried out in MATLAB/Simulink. The system is decoupled into two single-input single-output (SISO) systems. Comparing the performance of the optimized proportional, integral and derivative (PID) controller provided by INTECO, results depict that LQR controller gives a better performance in terms of both transient and steady state responses when PSO is performed.

Keywords : LQR controller, optimal control, particle swarm optimization (PSO), two rotor aero-dynamical system (TRAS)
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