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Design and Implementation of PD-NN Controller Optimized Neural Networks for a Quad-Rotor

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Abstract : In this paper, a full approach of modeling and control of a four-rotor unmanned air vehicle (UAV), known as quad-rotor aircraft, is presented. In fact, a PD and a PD optimized Neural Networks Approaches (PD-NN) are developed to be applied to control a quad-rotor. The goal of this work is to concept a smart self-tuning PD controller based on neural networks able to supervise the quad-rotor for an optimized behavior while tracking the desired trajectory. Many challenges could arise if the quad-rotor is navigating in hostile environments presenting irregular disturbances in the form of wind added to the model on each axis. Thus, the quad-rotor is subject to three-dimensional unknown static/varying wind disturbances. The quad-rotor has to quickly perform tasks while ensuring stability and accuracy and must behave rapidly with regard to decision-making facing disturbances. This technique offers some advantages over conventional control methods such as PD controller. Simulation results are obtained with the use of Matlab/Simulink environment and are founded on a comparative study between PD and PD-NN controllers based on wind disturbances. These later are applied with several degrees of strength to test the quad-rotor behavior. These simulation results are satisfactory and have demonstrated the effectiveness of the proposed PD-NN approach. In fact, this controller has relatively smaller errors than the PD controller and has a better capability to reject disturbances. In addition, it has proven to be highly robust and efficient, facing turbulences in the form of wind disturbances.

Keywords : hostile environment, PD and PD-NN controllers, quad-rotor control, robustness against disturbance
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