A SURVEY OF CONTROLLER DESIGN METHODS FOR A ROBOT MANIPULATOR IN HARSH ENVIRONMENTS

Agbaraji Chukwudi Emmanuel
Nnamdi Azikiwe University Awka
NIGERIA

H.C. Inyiama
Nnamdi Azikiwe University, Awka
NIGERIA

ABSTRACT

The rate of deployment of robots in the industries is highly increasing day by day and many of these robots are located to work in harsh environments such as deep waters. The controller is a vital subsystem of the robot manipulator system that is designed to help the system achieve stability, good disturbance rejection and minimum tracking error. There are many research works carried out on the robot arm controller design. Majority of these works as reviewed, focused more on the performance of the robot arm in terms of rise time, settling time and overshoot, with little study on the robustness of the control system. This research work focuses on the survey on controller design methods for a robot manipulator that can perform optimally in harsh environments. Proportional-Integral-Derivative (PID) controller tuning methods such as the manual, Ziegler Nichols, software tool, fuzzy logic, Genetic Algorithm (GA), and the Artificial Neural Network (ANN) methods were reviewed. From the review, it was concluded that it is difficult to achieve optimal performance using manual and Zeigler Nichols methods. Fuzzy logic, GA and ANN methods can be used to achieve desired optimal performance but they lack the parameters to evaluate the disturbance rejection settling time which helps to determine how fast the system can cancel or reject disturbance in harsh environments. On the other hand, the software tool method using PID tuner can be used to achieve the desired performance and good disturbance rejection settling time which satisfies the goal of the design.

Keywords: Robot Manipulator, Controller, PID, Control System, Robustness.