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IJIE

Journal homepage: http://penerbit.uthm.edu.my/ojs/index.php/ijie

The International Journal of Integrated Engineering

Controlling the non-parametric modeling of Double Link Flexible Robotic Manipulator using Hybrid PID tuned by P-Type ILA.

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DOI: https://doi.org/10.30880/ijie.00.00.0000.00.0000
Received 16 August 2018; Accepted 22 November 2018; Available online 30 November 2018

Abstract: Utilization of robotic manipulator with multi-link structure encompasses a great influence in most of the present industries. However, controlling the motion of multi-link manipulator has become a troublesome errand particularly once the flexible structure is employed. As of now, the framework utilizes the complicated arithmetic to resolve desired hub angle with the coupling result and vibration within the framework. Hence, this research aims to develop a dynamic system and controller for double-link flexible robotics manipulator (DLFRM) with the enhancement on hub angle position and vibration concealment. The research utilised neural network because the model estimation supported NARX model structure. In the controllers' development, this research focuses on self-tuning controller. P-Type iterative learning algorithm (ILA) control theme was enforced to adapt the controller parameters to fulfill the required performances once there is changes to the system. The hybrid of proportional-integral-derivate (PID) controller was developed for hub motion and end-point vibration suppression of every link respectively. The controllers were tested in MATLAB/Simulink simulation setting. The performance of the controller was compared with the fixed hybrid PID-PID controller in term of input tracking and vibration concealment. The results indicated that the proposed controller was effective to maneuver the double-link flexible robotic manipulator to the specified position with reduction of the vibration at the tip of the DLFRM structure.

Keywords: flexible robotic manipulator, Neural Network, Iterative learning algorithm, vibration suppression

1. Introduction

The wide advancement in different field of life such as domestics and industries make an incredible demand for flexible robot controller. Numerous robot controller applications are categorized as multiple-input-multiple-output (MIMO) frameworks owing to multi-link structure. The design and tuning of multi-loop controllers to meet certain conditions are regularly the pullback factors since there are interaction between the controllers. The framework must be decoupled to diminish the interaction or to form the framework diagonally dominant. Additionally, the existence of vibration on flexible structure of robot controller must be treated at the same time. The ceaseless stress delivered by the vibration can lead to structural deterioration, fatigue, instability and performance degradation. In this way, the decrease of vibration on flexible structure of robot controller is of foremost significance. In spite of the fact that numerous analysts

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