SINGLE INPUT FUZZY LOGIC CONTROLLER FOR FLEXIBLE JOINT MANIPULATOR

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ABSTRACT. *Joint elasticity in the dynamics of robots manipulator makes the conventional model-based control strategies complex and difficult to synthesize. This paper presents investigations into the development of single input fuzzy logic controller (SIFLC) for tip angular position tracking and deflection angle reduction of a flexible joint manipulator system. A Quanser flexible joint manipulator system is considered and the dynamic model of the system is derived using the Euler-Lagrange formulation. The proposed method, known as the SIFLC, reduces the conventional two-input FLC (CFLC) to a single input single output (SISO) controller. Two parallel SIFLC are developed for both tip angular position and deflection angle control. The proposed control scheme is also compared with existing results by Ahmad et al., which are hybrid proportional-derivative (PD) with low-pass filter (LPF) and PD with non-collocated fuzzy logic control schemes. The performances of the control schemes are assessed in terms of tip angular tracking capability, level of deflection angle reduction and time response specifications. Finally, a comparative assessment of the control techniques is presented and discussed.*
Keywords: Flexible joint, Vibration control, Intelligent controller, Classical controller

1. **Introduction.** Recently, flexible joint manipulators have received a growing number of attention from many researchers due to its light weight, high manoeuvrability, flexibility, high power efficiency, and large number of applications. Nevertheless, controlling such systems still faces numerous degrees of difficulties that need to be addressed before they can be used in abundance in everyday real-life applications. The control issue of the flexible joint is to design the controller so that link of robot can reach a desired position or track a prescribed trajectory precisely with minimum deflection to the link. In order to achieve these objectives, various methods using different technique have been proposed, such as adaptive output-feedback controller based on a back stepping design [1-3], nonlinear control approach using namely feedback linearization technique and the integral manifold technique [4,5], robust control design [6,7]. However, their work requires a nonlinear control theory which needs a complicated mathematical analysis. To reduce the complexity of the controller design, hybrid control scheme is introduced which can be realized by utilizing control strategies consisting of either non-collocated with collocated feedback controllers [8] or feed-forward with feedback controllers [9,10].