MECHATRONICS BOOK SERIES

CONTROL AND INTELLIGENT SYSTEMS

Momoh Jimoh E. Salami
Abiodun Musa Aibinu
Yasir Mohd Mustafah

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EDITOR

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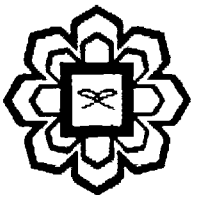

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Chapter 19
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19.1 Introduction

Flexible links are widely used in the designing of light weight robotic systems. As they can be used in a low energy environment such as in space, the flexible links have received much attention from many researchers during the past decades [1-5]. However, the flexural behavior of the arrangement in an already nonlinear robot system considerably complicates analysis and design. Because of this nonlinearity, traditional linear control techniques cannot effectively control a system of this kind. Therefore, there is a need for nonlinear control methods.

Fuzzy logic approach has distinguished itself among other nonlinear techniques due to its ability to incorporate human linguistic information into controller design [3]. Besides, it does not require mathematical modelling, which is normally employed in classical control design.

The use of fuzzy logic approach to control flexible link is an ongoing effort. Many challenges are still abound with respect to the acquisition of the expert knowledge, and its application in the design of the controller. This has to do with both position and tip vibration control/suppression of the system.

This chapter is organized as follows. Section 19.2 describes the system and the control objectives. Section 19.3 presents fuzzy-based control design and simulation results. Section 19.4 provides the description of the experimental setup. Section 19.5 discusses the results obtained. Finally, Section 19.6 concludes the chapter.

19.2 System Description and Control Objectives

An existing laboratory experimental flexible link system by QUANSER [6] is adopted in this study. The system has shown in Figure 19.1 comprises of a flexible link module coupled with servo motor. The system is equipped with a strain gauge and encoder to measure the tip vibration and position respectively. The system exhibits two output response in terms of the hub position, θ and the flexible tip vibration motion, α.

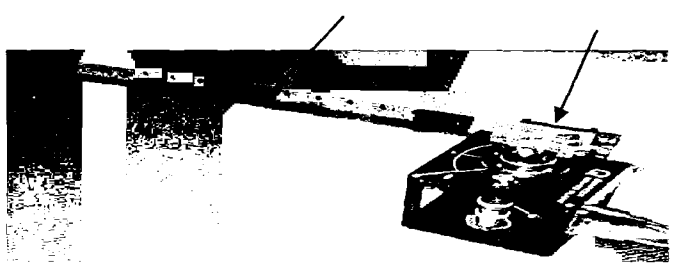

Figure 19.1: Quanser Laboratory Flexible Link a System