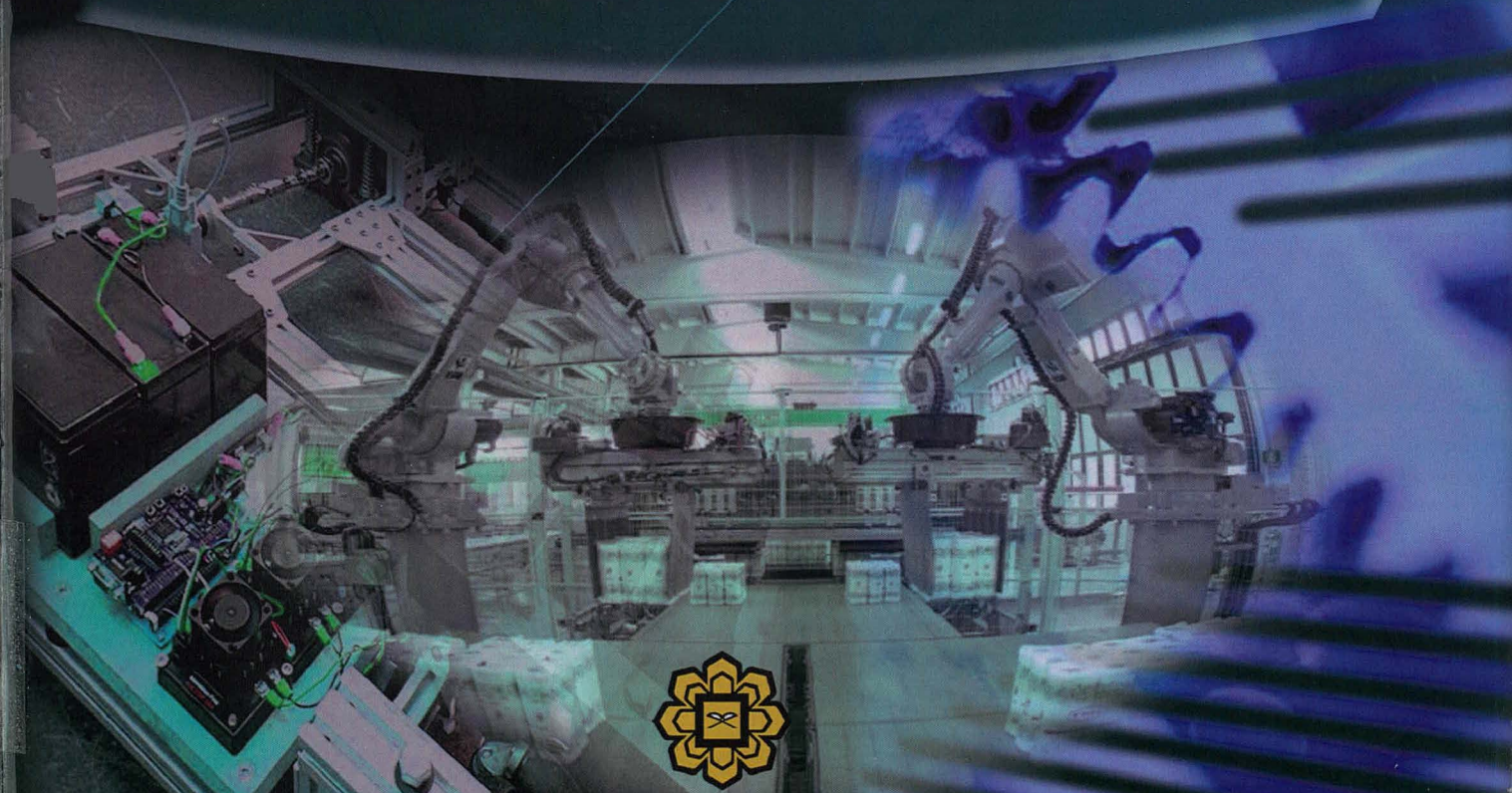
MECHATRONICS BOOK SERIES

CONTROL AND INTELLIGENT SYSTEMS

Momoh Jimoh E. Salami
Abiodun Musa Aibinu
Yasir Mohd Mustafah



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Chapter 38
System Modelling of a Twin rotor System: Time and Frequency Domain Analysis

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38.1 Introduction

Soft computing refers to a consortium of computational methodologies. Some of its principal components include Fuzzy logic (FL), Neural networks (NNs) and genetic algorithms (GAs), all having their roots in artificial intelligence (AI). In today's highly integrated world, when solutions to problems are cross-disciplinary in nature, soft computing promises to become a powerful means for obtaining solutions to problems quickly, yet accurately and acceptably. In the triumvirate of soft computing, NNs are concerned with adaptive learning, non-linear function approximation, and universal generalization. Neural networks are simplified models of the biological nervous system and therefore have drawn their motivation from the kind of computing performed by a human brain. An NN in general is a highly interconnected network of a large number of processing elements called neurons in an architecture inspired by the brain. An NN can be massively parallel and therefore is said to exhibit parallel distributing processing.

There has been an explosion in the literature on NNs in the last decades or so, whose beginning was perhaps marked by the first IEEE International Conference on Neural Networks in 1987. It has been recognised that NNs offer a number of potential benefits for applications in the field of control engineering, particularly for modelling non-linear systems. Some appealing features of NN are its ability for learning through examples, they do not require any *a priori* knowledge and can approximate arbitrary well any non-linear continuous function [1]. A number of techniques and interesting discussions of NNs from a system identification viewpoint have been provided in the literature, [2-5]. This chapter will present a method of system modelling using non-parametric identification techniques where NN is utilized.

The first part of the chapter will explain the NN architecture based on multi-layer perceptron (MLP). A Levenberg-Marquardt learning algorithm is used to train the empirical model. The responses the experimental based model is compared with those of the real TRMS to validate the accuracy of the model. Hence, the performances of the models are also compared with respect to each other. The model obtained for the TRMS will be used in subsequent investigations for the development of dynamic simulation, vibration suppression and control of the twin rotor system.