

## PROCESS FAULT DETECTION USING HIERARCHICAL ARTIFICIAL NEURAL NETWORK DIAGNOSTIC STRATEGY

MOHAMAD RIZZA OTHMAN<sup>1</sup>, MOHAMAD WIJAYANUDDIN ALI<sup>2\*</sup> &  
MOHD ZAKI KAMSAH<sup>3</sup>

**Abstract.** This paper focuses on the use of artificial neural network (ANN) to detect and diagnose fault in process plant. In this work, the ANN uses two layers of hierarchical diagnostic strategy. The first layer diagnoses the node where the fault originated and the second layer classifies the type of faults or malfunctions occurred on that particular node. The architecture of the ANN model is founded on a multilayer feed forward network and used back propagation algorithm as the training scheme. In order to find the most suitable configuration of ANN, a topology analysis is conducted. The effectiveness of the method is demonstrated by using a fatty acid fractionation column. Results show that the system is successful in detecting original single and transient fault introduced within the process plant model.

*Keywords:* Process fault detection and diagnosis, hierarchical diagnostic strategy, artificial neural network, fatty acid fractionation column

**Abstrak.** Kertas kerja ini menerangkan mengenai kegunaan jaringan neural tiruan (ANN) untuk mengesan dan membaiki kesilapan dalam loji proses. Dalam penyelidikan ini, ANN menggunakan dua lapisan dalam strategi diagnostik hirarki. Lapisan pertama mengenal pasti nod di mana kesilapan bermula sementara lapisan kedua membahagikan kesilapan yang berlaku pada nod tertentu. Arkitek model ANN adalah berasaskan beberapa lapisan rangkaian suapan hadapan dan menggunakan algoritma luncuran belakang dalam skema latihan. Untuk mendapatkan konfigurasi ANN yang terbaik, analisis topologi dilakukan. Keberkesanan kaedah ini ditunjukkan oleh kajian kes melibatkan turus pemecahan asid lemak. Keputusan menunjukkan sistem ini berjaya mengesan kesilapan tunggal dan fana yang terdapat dalam proses tersebut.

*Kata kunci:* Pengenalpastian dan diagnostik kesilapan proses, strategi diagnostik hirarki, jaringan neural tiruan, turus pemecahan asid lemak

### 1.0 INTRODUCTION

Plant operation today is becoming more complex as plants are often operated at extreme pressures and temperatures to achieve optimal performance. These extreme conditions may cause equipment failures and deviation in process that may lead to catastrophic

<sup>1</sup> Kolej Universiti Kejuruteraan dan Teknologi Malaysia, Locked Bag 12, 25000, Kuantan, Pahang, Malaysia

<sup>2&3</sup> Process Control and Safety Laboratory, Faculty of Chemical and Natural Resources Engineering, Universiti Teknologi Malaysia, 81310 UTM Skudai, Johor, Malaysia

\* Corresponding author: Tel: +06-07-553 5602, Email: m.w.ali@fkkksa.utm.my