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Performance Assessment from Resilience Engineering and HSEE Perspective through an Integrated Intelligent Algorithm: The Case of a Gas Refinery

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***Abstract*— This study employs a flexible intelligent algorithm based on adaptive neural network (ANN) and adaptive neuro fuzzy inference system (ANFIS) approaches for performance assessment from an HSEE-resilience engineering (RE) perspective. A gas refinery in Iran is taken as the case study to implement the algorithm. The average results of each category of HSEE and principles of RE account for the inputs and outputs of the intelligent algorithm, respectively. Employing the algorithm, the efficiency of the operators are calculated. The individual effect of each of the HSEE and RE factors on the efficiency of the operators is investigated. Furthermore, comprehensive sensitivity analyses are performed to demonstrate the superiority of the models. Lastly, outlier operators are identified using normality test.**

Keywords-performance assessment; resilience engineering; HSEE; artificial neural network; adaptive neuro fuzzy inference system

I. INTRODUCTION

In today's highly competitive environment, the main objective of any industry, or in other words, management's primary attempt is to maximize net benefit associated with the main process. In this context, health, safety, environment and ergonomics (HSEE) management has to be taken into account as the management of constraints on the process parallel to the main objective. This implies that maximization of the main process profits should be achieved under the constraints of acceptable occupational health, tolerable environmental impact, satisfactory degree of safety as well as adequate and sufficient application of both micro-ergonomics and macro-ergonomics factors in the organizational level.

A. HSEE

Human, safety and environment management at the operational level aims to eradicate or at least reduce injuries, adverse health influences and harm to the environment. Ergonomics is a subject related to all those factors that can influence people and their behavior. Effective utilization of ergonomics in work system design can lead to an equilibrium between worker's characteristics and job requirements. The main purpose of ergonomics is to improve operator's productivity, enhance worker's safety (both physical and mental) and bring about job satisfaction. Most plants use the term HSE to describe health, safety and environment as one single entity. Numerous papers have studied ergonomics and proved positive impacts of implementing ergonomics rules to the workplace including equipment, job and environmental design [3, 4], [17].

Ergonomics covers a wide range of programs from work place and equipment design to work regulation, communication, organization and system design. Macro-ergonomics is defined as the plans and actions which are related to macro-level in organization. Examples of these programs include training, education, regulation, communication and team-work. On the other hand, micro-ergonomics refers to the strategies regarding tool design, work-place design, lifting, transportation, work shift schedule, etc. As Azadeh et al. [5] state, there are close relationships between health, safety, environment and ergonomics factors. The safety of the work place for the operator can decrease due to unsuitable design between human and machine. The aim of an ergonomics program both in macro and micro level is to reduce accidents, and improve productivity and efficiency through fitting the