FRAME OPTIMIZATION USING NEURAL NETWORK

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5.1 Proposed Executive Summary

The motivation for the development of neural network technology stemmed from the desire to develop an artificial system that could perform "intelligent" tasks similar to those performed by the human brain. The true power and advantage of neural networks lies in their ability to represent both linear and non-linear relationships and in their ability to learn these relationships directly from the data being modeled. Neural networks resemble the human brain in the following two ways:

- A neural network acquires knowledge through learning.
- A neural network's knowledge is stored within inter-neuron connection strengths known as synaptic weights.

The literature studies that had been conducted showed previous and current works on Neural Network application. Adeli et.al. [13] and Iranmanesh and Kaveh [14], investigated the application of Neural Network on truss structures. Accurate results were reported.

This proposed research will explore Neural Network for optimization of frame structure configuration. Stress and displacement constraints will be considered with minimum weight as the optimum criteria. The developed algorithm/procedure will make use the Neural Network's powerful data modeling tool that is able to capture and represent complex input/output relationships. On the frame analysis side (for obtaining the structural responses), Finite Element method will be employed. The whole system will be a combination of neural network tool routine and the finite element routine. It is expected that the Neural network will be able to deal with complexities of frame structural optimization. The develop technique will contribute in the structural optimization knowledge.

5.2 Enhanced Executive Summary

This research addressed the performance of Neural-network (NN) to the structural optimization concept of frame structure. The development of NN technology stemmed from the desire to create an artificial system that could perform "intelligent" tasks similar to those performed by the human brain. The optimization part is performed using Finite Element software. Stress and displacement constrains has been chosen as the optimum criteria. The optimized data taken from FE analysis had been trained through Back Propagation Neural-network technique (BPNN) in order to identify the capability of this strategy to predict the exact data. Three case study were performed with different complexity of structural configuration. Result indicates the Neural-network were found capable of predicting the exact solution with proper training but this ability depended on the complexity of the frame structural optimization itself.

5.3 Introduction

Design optimization is an application of numerical algorithms and techniques in engineering applications which used to improve the system's performance, weight, reliability, and/or cost. Based on these advantages, researchers always improvise their strategy in this area by introducing new techniques or methodologies to meet the optimization criteria. The structural design also adapt to the trend where optimization concept always implemented in any structural design decision.

An optimum structural design is a design that minimizes (or maximize) a certain objective function, and still meets its design requirements. For many structures, more especially in aircraft structures, the objective function normally is weight of structure, while the design requirements are strength and stiffness among others. Normally, the optimization is performed on the size of the structural members. Performing structural optimization by involving its configurations as variables will offer more flexibility in the design and also opens up the design space.

Optimization techniques grow tremendously in this century. Neural-network (NN) for example has become a popular approach to solve the optimization problems. Its ability to perform constraints check while require less computational effort to produce optimized results amazed the researchers to use it as well as to produce modified or extended algorithms. The strength of the neural networks lies in their ability to represent both linear and non-linear relationships and capable to learn these relationships directly from the data being modeled.