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A review on

An artificial neural network based on genetic algorithm for prediction of structural response of multistoried r.c.c. Structure under earthquake excitation

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Abstract— Reinforced concrete structures exhibit complexities in their structural behavior Under the Earthquake excitation due to the composite nature of the material and the magnitude of earthquake and variety of factors that affect such behavior. As such, current methods for the design and analysis of reinforced concrete slabs are limited in scope and are approximate at best as they must rely on the results of experimental tests, which are both costly and time consuming to perform. The research embodied by this title investigates the use of a branch of artificial neural network (ANN) based on genetic algorithm known as Neural Networks (NN) as a quick and reliable alternative to such experimental testing. Multistoried R.C.C. structures are the need of the society in this modern era of 21stcentury due to the limited availability of land. These multistoried R.C.C. structures are widely used for different purposes like residential, commercial, industrial, etc. Earthquake is most common natural calamity which causes the impact on the stability of R.C.C. structure.

Artificial Neural Networks (ANN) based on genetic algorithms a preliminary alternative to mathematical modeling or experimental testing for quick prediction of the structural response of multistoried reinforced concrete structures. Such predictions could be used by a structural engineer on a preliminary basis to decide the initial suitability of a particular structure. Once this suitability was determined the engineer could then proceed with further, more traditional methods of design.

I've found number of literatures which focused on applications of ANN in RCC structure design, applications of genetic algorithm on response of RCC structure. One of the literature "A NEURAL NETWORK APPROACH FOR PREDICTING THE STRUCTURAL BEHAVIOR OF CONCRETE SLABS" by Susan Hentschel in 1998, but it was limited to RCC slabs only. My research is focusing overall structural response of RCC structure under Earthquake Excitation

Keywords— Neural Networks, artificial neural network, R.C.C. structure.

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1. Introduction

1.1 Neural Networks and Reinforced Concrete Structures

Reinforced concrete slabs are used today in a variety of applications including building floor systems, bridge decks, and offshore oil platforms. In these applications, concrete is selected over other building materials primarily due to the superior formability, durability, £ire resistance and insulation capabilities of concrete. Reinforced concrete, however, is composite

and non-homogeneous by nature therefore exhibiting non-hear or inelastic behavior. Collations to predict the structural behavior of concrete slabs are therefore simplifies and a p p r o d e at best and most often are formulated from the results of experimental testing on fid or reduced-scale mockups of the slabs. Such tests require expensive setups and lengthy periods of time are involves in the performance of these tests. The structural behavior of reinforced concrete is affected by many factors such as

1) Concrete properties; 2) aggregate properties; 3) reinforcement steel properties; and 4) geometric prophesy of the structural element. Mathematical models have been used to describe aspects of this behavior, but they fall short in considering a large number of variables simultaneously. This thesis investigates the use of Neural Networks (NN) as a preliminary alternative to mathematical modeling or experimented testing for quick prediction of the *structural* behavior of reinforced concrete slabs. Such predictions could be used by a structural engineer on a preliminary basis to decide the initial suitability of a particular slab design. Once this suitability was determined the engineer could then proceed with further, more traditional methods of design. This will serve to illustrate 1) the simple manner by which neural networks mode1 the impact of a set of parameters (inputs) on a *set* of simultaneous conclusions (outputs); and 2) the powerful learn by example and generalization mechanism that neural networks use to detect the hidden relationships linking the inputs to their outputs (Hegazy et al., 1996). Neural networks are computational models that adopt a training mechanism to extract the relationships that link a set of causal input parameters to the resulting conclusions. Once neural networks are train, they can predict the results for an unknown case (not used in training) if provided with the input parameters alone. Some characteristics of neural networks that make them potentially useful for many different types of applications are (Moseihi et al., 1992):

a) Neural networks are organized with a parallel decentralized structure rather than the serial architecture found in conventional computer algorithms. As a result, processing occurs in a rapid manner; They have distributed memories; neural network memories are represented by interconnection weights spread over all of the network's processing elements; They are *fault* tolerant, that is, they are *still* functioned men after several processing elements are *damage* and become defective;

b) They have the ability to learn-by-example; They have the ability to simulate the behavior of systems with limited modeling effort; and

c) They can provide speedy and reasonably accurate solutions in complex, uncertain, and subjective situations.

Objectives:

1. Identify the detailed factors that govern the response of multistoried RCC Structure.

2. Investigate the suitability of neural networks for application in the structural analysis domain.

3. Develop, train and implement a set of neural networks to predict the response of RCC structures.

4. Compare the results of these neural networks with the results obtained from conventional methods to find out the response of RCC structure under Earthquake Excitation.

5. Develop a comprehensive spreadsheet tool for the structural analysis of RCC structures.

Methodology:

The research methodology is as follows:

1. Evaluate the problem by reviewing the theory and current practices in both neural networks and the prediction of response of RCC structure under Earthquake excitation. Examine the literature to identify past work, both experimental and theoretical.

2. Model the response of RCC structure in four complementary aspects, each of which lends itself to an Artificial Neural Network (ANN):

a) load-deflection behavior prediction;

b) Crack pattern prediction;

c) Concrete strain distribution; and

d) Reinforcing steel strain distribution

3. Select appropriate Artificial Neural Network software. Then, conduct a preliminary investigation on the load-deflection neural network to determine the suitability of the neural network technique for the problem at hand. Experiment with different ways of modeling the problem to achieve the optimum results.

4. Once a suitable neural network model is selected, repeat the process for the remaining three neural networks.

5. Incorporate all four neural network models into a single spreadsheet tool to summarize the research completed.

6. Validate the concepts proposed in the research scope and objectives

Research time plan (Char):

Phase I:- Finding Out the literature regarding problem statement,

Phase II:- Examine the literature to identify past work, both experimental and theoretical.

Phase III:- ANN model making with respect to Different complimentary aspects using past experiences.

Phase IV:- Making of Spread Sheet for research completion.

Phase V:- Report Writing

Phase IV:- Thesis Submission.

Possible outcome:

After completing this research work we can find the proper way out which can be analytical and time optimizing as well as modern method to predict the response of multistoried RCC structure under Earthquake excitation. Due to this Structural Engineer can get an accurate considerations regarding seismic design and the loss due to the damage of earthquake can be minimized.

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