



Using support vector machine model to study of dynamic response of guyed tower subjected to earthquake loading

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Abstract

Guyed towers are important in telecommunication systems. So, it is important to protect them against natural events specially earthquake. In this paper, seismic behavior of guyed towers are studied. For that, some of guyed towers under earthquake forces are studied. The research is on the based of two kind of forces: wind and earthquake forces and tower interaction to these forces. Here, the effect of earthquake forces and tower response to seismic events are studied. At first, modal analysis are used in determination of towers vibration natural modes, then, under time- acceleration components of El-Centro earthquake, spectral analysis are performed. Analysis outputs are provided using ANSYS software and two parameters including frequency and maximum lateral displacement. The results are used in comparison of two different calculation models: genetic programming and cellular automata.

Keywords: Guyed tower, cellular automata, genetic programming.

1. INTRODUCTION

In the wireless, microwave and satellite communication industry, guyed towers are one of the important structural subsystems. In this paper, seismic behavior of guyed towers under earthquake force is studied. Generally, these towers are tall and thin structures that depends on guy lines for stability. For a guyed tower, wind and ice are the majors loads. Therefore, a proper evaluation of the response due to wind and/ or ice may decrease the occurrence of failures, so these loads are used in analysis of their structure [1]. The researches on guyed towers are divided to wind forces and cables interaction. In recent years, earthquake effects on towers are considered and the result of analysis of earthquake and wind are compared. Therefore, in this paper, it seems reasonable to study the effects earthquake and seismic response of tower.

In this day and age, artificial intelligence techniques and machine learning methods are used in different sciences. Using these techniques, many of scientists have provided complex models. Support vector machine (SVM) is a new technique which has better function than neural network because it has simple learning, it is not bounded to local maximum and has accurate function in expanded data processing [2]. So in this research, SVM has used to provide a model to anticipate dynamic response of guyed tower under earthquake force

2. GUYED TOWERS

Due to the importance of communication and using this technology in industries, it is necessary to design and analysis of special structures to installation and supporting of accessories such as antenna, reflectors and dishes. Guyed Towers are lightweight to heavyweight towers supported by guy wires and are designed with the ability to carry light to heavy antenna loads, signal absorption, amplification and relay. Radio and telecommunication signals are depends on the height of transmission focus to cover an area, self supporting towers are not suitable in height of more than 150 m. So, guyed towers taller than 150m (about 600m) usually provide economic solution comparing to self supporting towers. A typical tall guyed tower are shown in Fig.1. Guyed Towers are typically made of a steel mast in triangular cross-section and hinged support [3].