

Dynamic Analysis of Innovative Hybrid Wind Mill Tower Considering Soil Structure Interaction

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Abstract

The wind mill towers are constructed using monopoles or lattice type tower. As the height of tower increases it gives more power but it becomes uneconomical, so in the present research work innovative hybrid wind mill tower such as combination of monopole and lattice tower is analyzed using FEM software. When the tall structures are constructed on soft soil it becomes dynamically sensitive so 3 types of soil such as hard, medium and soft soil is also modelled and the innovative hybrid tower is studied for different operating frequencies of wind turbine. From study it is concluded that the innovative hybrid tower will reduce resonance condition considering soil structure interaction.

Keywords: Wind mill Tower, Dynamic Analysis, Resonance Conditions, Soil Structure interaction

1 Introduction

From the mid part of the 19th century to today, fossil fuels have provided the power necessary to complete many of society's most basic tasks worldwide. But in the recent years the renewable sources of energy becomes most popular and there is more advancement in the technology.

One of the important sources of power generation is wind mills. According to details available from ministry of new and renewable energy Government of India^[8] total wind power potential of 302251 MW has been estimated at 100 meter height In India, and only three states Tamil Nadu, Rajasthan, and Madhya Pradesh have tapped about 21 per cent of the total potential available in states. Other states like Gujarat, Karnataka, Kerala has utilized only 3 to 5 percent of their wind power potential. All states of India has total wind power utilization is only 26777 MW which is only

8.86 percentage of the total wind power potential available in major states of India. The wide gap between the installed capacity and the assessed potential in India clearly indicates the opportunity in this field. So to utilize all available wind power potential there must be more advancement in the wind mill technology. The height of the wind mills is increased in the recent years to extract more power at higher elevations. Basically two types of tower system such as monopoles or lattice towers are used for the wind mill supporting towers. Each types of tower have its own advantages and disadvantages. As the height of the wind mill increases the thickness of the wall of the monopole towers are increasing and it untimely leads to increase in cost and uneconomical sections. On the other hand the lattice towers are formed by connecting the various angle or box sections by doing proper riveting at the site. The lattice towers will resist the loads by truss action of the members so members of towers are subjected to axial forces only. As the lattice