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Research paper

Design and Analysis of Power Transmission Monopole Using ETABS

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Abstract

Electricity consumption is day by day increase for each and every application. Transmitting the power source from production place to designation place via steel wire is followed by ancient people. In this we use heavy towers which carry minimum of 2000kw power in each line which is hanged in the towers. These towers are subjected to dynamic and static load cases. Hence in this thesis we proposed to design and analysis the power transmission towers in our places. We introduce type of tower and its configuring ratio as per Indian standard IS-802. A standard kind of transmission line tower selected as case examine is analyzed and modeled the usage of ETABSs software. Loads acting on the tower are wind load, dead load of the structure, braking load of conductor and earthquake load considered as per Indian standard. The place of tower underneath seismic and wind is region III. The wind pressure depends on the gust response component which will increase with height. Seismic and wind analysis is finished the usage of standard codes using ETABSs software program. The conduct of tower is analyzed for distinctive load mixtures. The most displacement values, shear forces and bending moments are obtained and are plotted graphically.

Keywords: *Design, Analysis, Power Transmission, Monopole and ETABS.*

1. Introduction

Energy machine stabilizers (EMS) are used as supplementary manipulate devices to provide more damping and improve the dynamic overall performance of the energy machine. EMS are very effective controllers in improving the damping of low-frequency oscillations because they could increase the damping torque for inter place modes through introducing extra signals into the excitation controllers of the mills. Those oscillations come into lifestyles while mills fall out of step from every different. Depending on their location in the device, a few generators participate in a unmarried mode of oscillation, whereas others take part in a couple of mode. Researchers were putting lots of efforts in the design of most advantageous to meet specific gadget requirements. Numerous design techniques have been suggested. Those algorithms hire big wide variety of particles or individuals in the optimization. Tab is software where we will simulate electricity device components. In this study, the load on time is reduced and the simulation is as quick as feasible. For the metallic plant, first load float evaluation has been executed. The distinctive voltage profile, actual and reactive power injected to the gadget has been determined then quick circuit analysis is carried out for three segment fault and single phase to floor fault, the quick circuit contemporary is cited .then transient balance evaluation is noted and the plots have been proven. Herein ETABS, first the unmarried line diagram became drawn. Parameters had been given therefore and cargo drift, brief circuit and temporary stability had been done. in this paper the stairs worried for analysis of steam plant using ETABS modeling is illustrated beneath.

1.1. Objectives of Our Study

- To have a look at the analysis and layout of transmission line tower using e tabs software program.
- To study the evaluation of transmission line tower [Single circuit] for numerous loadings (lifeless load or self-weight, seismic load, wind load) appearing on it.
- To obtain displacements, bending moment, shear force, values for analyzed tower.
- To have a look at the member of sections taken into consideration within the evaluation, finding out the best sections for the tower.
- To calculate the wind stress forces performing at the tower, converting into point loads and sporting out wind evaluation.

1.2. Wireless Transmission

Power might also be transmitted by changing electromagnetic fields or by radio waves; microwave energy may be carried efficiently over short distances by a waveguide.

2. Methodology

Fig.1 shows the methodology in this study.

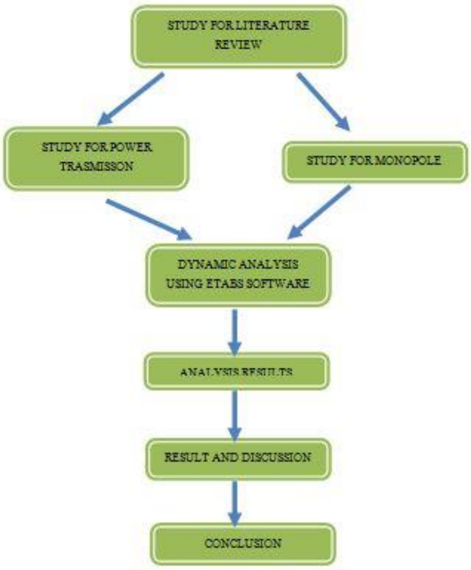

Fig.1: Methodology

3. Overhead Transmission

The present design exercise, towers and conductors are taken into consideration one after the other ignoring the coupling effect and static loads are implemented for my part. Coupled transmission tower-line systems are tremendously complex in their behavior due to the interplay between on-linear conductors and stiff towers which ends up in carefully spaced frequencies. Studied these systems thinking about the geometric non-linearity and aerodynamic damping; however the work became now not in three dimensions. Supplied linear reaction in a coupled gadget the usage of a three-D finite element model. Lately showed that the layout codes overestimate the energy of transmission towers. They added out that a 3-D finite element analysis is greater correct compared to linear evaluation. Until now, not many researchers have studied the coupling impact on reaction of cables using non-linear dynamic evaluation.

3.1. Design Tower

Pulleys that are of various size can be mounted on common shaft in an effort to be connected to motor shaft. Other set of pulleys might be set up on another common shaft. it's far to be noted that as pulleys are of various size, drives may have differential speed and the equal velocity may be conveyed to either side of electro-mechanical clutch. Without a electrical excitation to the seize, the input shaft & output shaft freely rotate. With electrical excitation, the enter shaft turns into coupled to the output shaft. Motor feeds the desired torque to force with the intention to be fed to magnetic seize as input whilst the burden torque is less than the output torque, the seize drives without slip. Load torque will be expanded steadily and while it crosses output torque, the clutch will slip easily at the torque stage set through the coil input cutting-edge as enter torque and cargo torque values are acknowledged, cost of load torque at which grasp slips might be taken as output torque. This output torque can be in comparison with enter torque to assess the torque transmitting capacity of the electricity transmission device.

4. ETABS Application

4.1. Description / Main Objectives of Model

ETABS unsegregated transmission applications were developed for concurrent offline and real-time use. ETABS can combine your load flow, short circuit, dynamic stability, and protection and SCADA models into one common and unsegregated integrated database. This is the next generation approach as opposed to the current industry practice of trying to couple offline system planning tools with real-time data via external files.

5. ETABS Results

5.1. Wind Load on Panels

The lateral force due to wind force performing at each panel joint is located as a manufactured from depth of wind and the exposed area of participants of the tower consist of the projected location of the windward pressure plus fifty percent of plant of the leeward force. Fig.2 suggests the dimensions of tower in meter

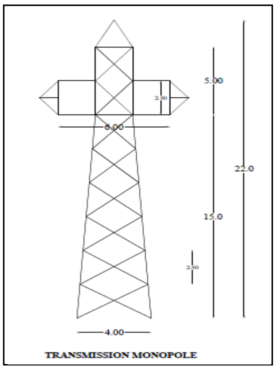

Fig.2: Dimensions of tower in meter

5.2. ETABS Report

Fig.3 shows the tower model in E-tabs

Fig.3: Tower model

5.2.1 Structure Data

Table 1 shows the model geometry information, including items such as story levels, point coordinates, and element connectivity.

Table 1: Story Data

Name	Height mm	Elevation mm	Similar To	Splice Story
Story10	2000	22000	None	No
Story9	2500	20000	None	No
Story8	1250	17500	None	No
Story7	1250	16250	None	No
Story6	2500	15000	None	No
Story5	2500	12500	None	No
Story4	2500	10000	None	No
Story3	2500	7500	None	No
Story2	2500	5000	None	No
Story1	2500	2500	None	No
Base	0	0	None	No

5.2.2 Properties

Table 2 and Table 3 show the property information for materials, frame sections, shell sections, and links.

Table 2: Material Properties – Summary

Name	Type	E MPa	v	Unit Weight kN/m³	Design Strengths
A615Gr60	Rebar	199947.98	0.3	76.9729	Fy=413.69 MPa, Fu=620.53 MPa
A992Fy50	Steel	199947.98	0.3	76.9729	Fy=344.74 MPa, Fu=448.16 MPa

Table 3: Frame Sections – Summary

Name	Material	Shape
DIA	A992Fy50	Steel Angle
HORI	A992Fy50	Steel Angle
MAIN	A992Fy50	Steel Angle
W14X500	A992Fy50	Steel I/Wide Flange

5.3. Frame Assignments

Table 4 shows the frame assignment summary.

Table 4: Frame Assignments – Summary

Story	Label	Unique Name	Design Type	Length mm	Analysis Section	Design Section	Min Number Stations
Story9	C5	89	Column	2500	MAIN	MAIN	3
Story9	C6	90	Column	2500	MAIN	MAIN	3
Story9	C7	91	Column	2500	MAIN	MAIN	3
Story9	C8	92	Column	2500	MAIN	MAIN	3
Story8	C1	5	Column	2500	MAIN	MAIN	3
Story8	C2	6	Column	2500	MAIN	MAIN	3
Story8	C3	7	Column	2500	MAIN	MAIN	3
Story8	C4	8	Column	2500	MAIN	MAIN	3
Story8	C9	121	Column	2500	W14X500	W14X500	3
Story8	C10	123	Column	2500	MAIN	MAIN	3
Story8	C11	127	Column	2500	MAIN	MAIN	3
Story8	C12	128	Column	2500	MAIN	MAIN	3
Story9	B1	39	Beam	2000	HORI	HORI	
Story9	B2	38	Beam	2000	HORI	HORI	
Story9	B3	37	Beam	2000	HORI	HORI	
Story9	B4	40	Beam	2000	HORI	HORI	
Story8	B5	113	Beam	2000	DIA	DIA	
Story8	B6	116	Beam	2000	HORI	HORI	
Story8	B7	117	Beam	2000	DIA	DIA	
Story8	B8	119	Beam	2000	HORI	HORI	

5.4. Loads

It shows loading information as applied to the model.

5.4.1. Load Patterns

Table 5 shows the load patterns

Table 5: Load Patterns

Name	Type	Self Weight Multiplier	Auto Load
Dead	Dead	1	
Live	Live	0	
W1	Wind	1	Indian IS875:1987
SEI I	Seismic	1	IS1893 2002

5.5. Indian is 875:1987 Auto Wind Load Calculations

5.5.1. Exposure Parameters

Exposure From = Diaphragms
Structure Class = Class B
Terrain Category = Category 2
Wind Direction = 0.90 degrees
Table 6 shows the Exposure parameters.

Table 6: Exposure parameters

Basic Wind Speed, V_b [IS Fig. 1]	$V_b = 50 \frac{meter}{sec}$
Windward Coefficient, $C_{p,wind}$	$C_{p,wind} = 0.8$
Leeward Coefficient, $C_{p,lee}$	$C_{p,lee} = 0.5$

Top Story = Story10
Bottom Story = Base
Include Parapet = No

5.5.2 Factors and Coefficients

Table 7 shows the coefficients.

Table 7: Coefficients

Risk Coefficient, k_1 [IS 5.3.1]	$k_1 = 1$
Topography Factor, k_3 [IS 5.3.3]	$k_3 = 1$

5.5.3 Calculated Base Shear

Table 9 shows the calculated base shear.

Table 8: Calculated base shear

Direction	Period Used (sec)	W (kN)	V_b (kN)
X	0.409	621.6055	55.9445
Y	0.442	621.6055	55.9445
X + Ecc. Y	0.409	621.6055	55.9445
Y + Ecc. X	0.442	621.6055	55.9445
X - Ecc. Y	0.409	621.6055	55.9445
Y - Ecc. X	0.442	621.6055	55.9445

6. Conclusion

This study conclude that dynamic load is more acting compare to the static loading in the tower which has find out and same has been protected from the damage. Structures like angle, box channel etc… has easily designed and analyzed has implemented in the study. Proposed design will enable the designer to recover part of energy required to test the transmission system. In addition the limitations given in different wind design codes in designing power transmission of tower are discussed.

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