International Journal of Electrical and Electronics Engineers
Vol. No. 9, Issue No. 01, January-June 2017
ISSN (O) 2321-2055
ISSN (P) 2321-2045

PLANNING OF DESIGN OF OVERHEAD TRANSMISSION LINE BY MATLAB PROGRAMMING

Prof. Mohan S. Tajne[1], Miss. Nishigandha N. Daware[2]

[1]*Asst. Prof., Dept. of Electrical Engg.*

Yashawantrao Chavan College of Engg. Nagpur, Maharashtra, (India)

[2]*Asst. Engineer, MSEDCL Nagpur, Maharashtra, (India)*

ABSTRACT

This paper aims to develop a solution for designing transmission lines which will leave the manipulation and calculation part for computer and just by feeding some basic data we will get an optimized design of a new transmission line. Thus this paper aims to bring a solution for engineers to the problems they are facing while designing a new transmission line. Transmission line design involves a lot of data manipulating and number of tedious calculations which take a major part of time required or devoted for planning and designing a new line. This software approach will provide a handy means for new ones entering in this field. The main objective of designing a high voltage transmission line is to transmit electrical energy at the lowest cost and with required reliability. Both electrical and mechanical design considerations are to be studied. Design of transmission line is a very complex task, since it includes designing of constantly changing parameters and design also includes very clear idea of the efficiency, regulation and losses. While designing transmission on lines various parameters are to be considered. They are as follows:

- *Voltage selection*
- *Size of conductors and spacing between conductors.*
- *Choosing number and type of type of insulators.*
- *Sag and Tension.*
- *Span Length and Ground clearance.*
- *Calculation of R, L, C and self GMD.*

Keywords: Overhead transmission line parameters, Matlab Programming.

I. INTRODUCTION

Expansion of Transmission and Distribution network commensurate with the addition of generation capacity and growth in demand is required, in order to extend a reliable, stable and secure power supply. This needs an optimal and economical planning of the transmission system.

Analysis of a Transmission system is technically complex, though in terms of economics and finance, it is not as great as Generation or Distribution. Typically for a given period, the investments in Transmission system are much less as compared to either Generation or Distribution. The objective of system planning is to evolve a power system with a level of performance characterized by an acceptable degree of adequacy and security based on a trade-off between costs and risks involved.

International Journal of Electrical and Electronics Engineers
Vol. No. 9, Issue No. 01, January-June 2017
ISSN (O) 2321-2055
ISSN (P) 2321-2045

Transmission planning is carried out to determine new Transmission facilities required over a planning horizon, timing of each addition / modification of the system and to select most suitable type for each new development stage. Capital cost requirements and investment plans associated with such plans should be developed.

II. TRANSMISSION PLANNING REQUIREMENTS

Basic requirements for carrying a transmission planning study

- **Information on the existing transmission facilities:**

Collection of all the available information on the existing system forms the first stage in the planning process. Data required is as given below. Data is usually available in the records maintained at the substations. Basic parameters required are, line voltage, number of conductors per phase, size and type of conductor and shield wire, Line resistance, reactance and susceptance (positive negative and zero se-quince), Size and location of line connected shunt reactors, Size and location of series capacitive compensation.

- **Generation plan :**

It includes all data and information regarding generation (i.e. various plants and their generating capacity etc.)

- **Load Forecast**

Load forecast is the process, which involves estimation of future loads and ways in which these loads can be met. The existence of a load forecast that covers the planning period is essential to the overall planning task and is the foundation for all the planning studies. Load forecasts carried out on a state-wide, regional or national basis provide satisfactory input to the generation.

III. PLANNING NORMS AND GUIDELINES

Load is a constantly changing variable and since the load and generation must be matched at all times to maintain a reasonably constant frequency, the duties imposed on a transmission system are infinitely variable within the extremes of minimum load and maximum load. To this must be added the uncertainties associated with both the load forecast and the generation plan. This will enable the power system to operate without any constraints in the event of any changesoccurring in the load forecast or the generation plan. Bulk transmission system connects major power plants to the regional load centers. This system delivers large blocks of power to the areas that contain large concentration of load. It normally operates at highest network voltage. This system also interconnects generating stations, and load centers. Bulk transmission system is operated as a meshed system and normally covers a wide geographical area.

At the bulk transmission level, there are two basic system types, known as integrated and non-integrated. Major generating plants are connected to major load centres in a non-integrated system, whereas an integrated system also connects major generating plants to each other and connects major load centres to each other.

A. Illustration 1

Voltage selection depends on various factors. The reason we are considering it first is because in our program the programmer will enter the value of voltage and on basis of that the transmission data will be provided to the programmer.

International Journal of Electrical and Electronics Engineers
Vol. No. 9, Issue No. 01, January-June 2017
ISSN (O) 2321-2055
ISSN (P) 2321-2045

A transmission line transmits electrical energy in bulk from generating station to distributing station. The maximum generation voltage in developed countries is 33KV while in India it is 11KV. The amount of power that has to be transmitted through transmission line is very large, if this power is transmitted at 11KV or 33KV, the line current and power loss would be large. Therefore this voltage is stepped up to higher value by using step-up transformers. The transmission voltages in India are 132KV, 220KV, 400KV and 765KV. The voltages used as standards in India are 11kV, 22kV and 33kV for short transmission line, 66kV and 110kV for medium lines and 132kV, 166kV, 220kV and 400kV for long lines. Recently, 765kV transmission line is under running paper. Also transmission system can be categorized as follows

- High Voltage:The voltage upto 220kV is called as high voltage
- Extra-high Voltage: The voltage between 220kV and 760kV is called as Extra-high voltage.
- Ultra- high voltage: The voltage above 760kV is called as Ultra -high voltage
- HVDC: This voltage is associated with DC and is above +/−600kV.

The corresponding maximum and minimum length of line according to standard volt-ages are given in the table: The system voltage in EHV system very much effect. The corresponding maximum and minimum length of line according to standard volt-ages are given in the table: The system voltage in EHV system very much effect the capital cost of transmission line.

Table1:Table of Max/Min length of line according to standard voltages

Line to Line Voltage (kV)	Length of line Minimum	(kilometers)Maximum
66	40	120
110	50	140
132	50	160
166	80	180
230	100	300

Selecting the transmission voltage the present and future expectable voltage of other lines in vicinity of the line under design are taken into account. The number of circuits in EHV system can be one or two.

The weight of conductor material, the efficiency of the line, the voltage drop in the line and system stability depends upon system voltage. The choice of voltage therefore, a major factor in the line designs.

Table 3: Table for Voltage Selection (According to Indian standard)

Distance(km)	Number of Phases	Standard Working Voltage(kV)
Upto 8	3	6.6
Upto 16	3	11
Upto 64	3	33
Upto 116	3	66
Upto 240	3	132
Upto 480	3	220
Upto 800	3	400

International Journal of Electrical and Electronics Engineers
Vol. No. 9, Issue No. 01, January-June 2017
ISSN (O) 2321-2055
ISSN (P) 2321-2045

B. Illustration 2

The paper "DESIGN OF TRANSMISSION LINE USING MATLAB" is a software paper in which the coding is done on MATLAB. In this for simplicity purpose we have done topic wise programming and then the final program is designed so that in this, it recalls the individual programs sequentially

IV.MATLAB PROGRAM

```
%final program for design of transmission
linesclc
clear all
V=input('Enter the value of voltage in "kV"='); choiceoc
Insulator
Gmd
Vr
Spanlength
Gndcl
Sagtens
Corona
Skineffect
```

V. PROGRAM FOR CHOICE OF CONDUCTOR

```
%program for choice of conductors
if(V<=33)
fprintf('Copper conductors are used \n');
cond=1;
else
fprintf ('ACSR conductors are used \n');
cond=2;
if(V==132)
fprintf('\n PANTHER ACSR conductors are used \n');
cond=2;
elseif(V==220)
fprintf('\n ZIBRA ACSR conductors are used \n');
cond=2;
elseif(V==400)
fprintf('\n MOOSE ACSR conductors are used \n');
cond=2;
end
```

International Journal of Electrical and Electronics Engineers
Vol. No. 9, Issue No. 01, January-June 2017
ISSN (O) 2321-2055
ISSN (P) 2321-2045

VI. PROGRAM FOR INSULATORS

```
%program to find type of insulator
if(V==11)
fprintf('One part type Pin insulators is used \n');
elseif(V==33)
fprintf('Two or Three part Pin type or Suspension or Strain
type insulator is used \n');
inst=1;
elseif(V==66)
fprintf('Suspension or Strain type insulators is used \n');
inst=2;
elseif(V==132)
fprintf('Suspension or Strain type insulators is used \n');
inst=3;
elseif(V==220)
fprintf('Suspension or Strain type insulators is used \n');
inst=4;
end
Vit=[3 3; 5 4; 9 8; 15 14];
strain=Vit(inst,1);
suspn=Vit(inst,2);
fprintf('The number of disc insulators used in strain type
tension insulator string=%f\n',strain);
fprintf('The number of disc insulators used in suspension
insulator string= %f\n',suspn);
```

VII. PROGRAM FOR SPAN LENGTH

```
%program to find span length
V=input('Enter the value of voltage in"kV"=');
if(V<=33)
sl=100;%span length in meters elseif(V==66)
sl=200;
span=1;
elseif(V==110)
sl=250;
span=1;
else
sl=300;
```

International Journal of Electrical and Electronics Engineers
Vol. No. 9, Issue No. 01, January-June 2017
ISSN (O) 2321-2055
ISSN (P) 2321-2045

```
span=1;
end
fprintf('The value of span length= %f m',sl);
```

VIII. PROGRAM FOR GROUND CLEARANCE

```
% program to find ground clearance if(V<=66)
gc=6; % ground clearance in meters
elseif(V>66 && V<=110)
gc=6.4;
elseif(V>110 && V<=166)
gc=6.7;
else
gc=7;
end
fprintf('The value of ground clearance is= %f m \n',gc);
```

IX. RESULTS OF PROGRAMMING

Now the output which we get on executing this program is as follows: In this we are designing for voltage of 220kV, 160Km transmission line and 85MW power.

```
Enter the value of voltage in "kV"=220
ACSR conductors are used
ZIBRA ACSR conductors are used
Suspension or Strain type insulators is used
The number of disc insulators used in strain type
tension insulator
string=15.000000
The number of disc insulators used in suspension insulator
String =14.000000
The value of span length=300.000000 m
The value of ground clearance is=7.00000 m
```

X. CONCLUSION

This paper is implemented through MATLAB programming. Mainly, we deals with the study of Electrical parameters. This paper will be fruitful in designing of trans-mission line as calculation part will be done by computer. In future this paper can further be extended by considering tower design, thereby studying mechanical parameters. Various others factors can be included for the detailed study.

XI. ACKNOWLEDGEMENTS

This paper implement orientation regarding design of the transmission line. Mainly we visited grid control and studied the various equipment's associated with it. For designing of the new transmission line, the total load to be catered by an EHV substation of a particular voltage level, its MVA capacity, number of feeders permissible etc. to know about the time for going in for adoption of next higher voltage level substation and also the number of substations required for meeting a particular quantum of load.

REFERENCES

[1] ChintuRzaMakkar, Lillie Dewan, "Transient stability enhancement using robust FACTS controllers – a brief tour," Canadian Journal on Electrical & Electronics Engineering volume 1, No. 7, December 2010.

[2] S. K. Srivasta, "Advanced Power Electronics Based Facts Controllers and Overview," Asian Power Electronics Journal, volume 4, No. 3 December 2010.

[3] A. Kazemi, B. Badrzadeh, "Modelling and Simulation of SVC and TCSC to Study their Limits on Maximum Loadability Point," Electrical Power and Energy System 26 (2004) 381 – 388, Elsevier LTD.

[4] Kaur; Dr. Tarlochan, Kakran; Sandeep, "Transient Stability Improvement of Long Transmission Line System by Using SVC" Vol. 1, Issue 4,October 2012.

[5] Reeve, J., Sener, F., Torgerson, D.R, Wood, R.R., "Proposed terms and dentitions for flexible AC transmission system (FACTS)", IEEE

[6] "Power system stabilityEnhancement using FACTS controllers" Proceedings ofInternational Conference on Emerging Trends in ElectricalEngineering and Energy Management, pp 84 – 87, 2012

[7] Dale A. Douglass. \Practical Application of High-Temperature Low-Sag (HTLS) TransmissionConductrors," Power Delivery Consultants, June 2004.

[8] 3M Company. \Aluminum Conductor Composite Reinforced (ACCR) - Frequently AskedQuestions," 3M Products & Services, June 2004.

[9] F. Kiessling, P. Nefzger, J.F. Nolasco, and U. Kaintzyk. Overhead Power Lines: Planning,Design, Construction. Springe-Verlag, Berlin Heidelberg, Germany, 2003.

[10] F. Kiessling, P. Nefzger, J.F. Nolasco, and U. Kaintzyk. Overhead Power Lines: Planning,Design, Construction. Springe-Verlag, Berlin Heidelberg, Germany, 2003.

[11] M. V. Deshpande, "Electrical Power System Design", Tata McGraw Hill Education Private Ltd., 2000.

[12] Ambriz – Perez, Cesar Angeles – Camacho, "FACTSModelling and Simulation in Power Networks," John Wiley & sons LTD, 2004.

[13] Hingorani; N. G., Gyugyi; L., "Understanding FACTS concepts and Technology of flexible AC transmission systems", New York.