SUMMARY

The reliability of the power system operation is greatly dependent on lightning since the system can not be made totally immune to this natural phenomenon. This is the reason why so much interest has been shown by various researchers all over the world in the study of various aspects of lightning. To assess the effect of lightning it is most important to measure the magnitude and the rate of rise of lightning current as correctly as possible. For estimation of surge voltage on a transmission system due to lightning, the electrical parameters of transmission line tower are also very important. These back-grounds form the basis of the present thesis.

The research presentation is organised in eight chapters as given below.

Chapter I presents the literature survey in chronological order the techniques used for the measurements of magnitude and rate of rise of lightning stroke currents. It also presents the different estimation methods used by various researchers to determine the line performance depending on lightning strokes. The importance of the effective inductance of tower in the process of estimation is highlighted. Based on these, the problem for the present thesis is indicated.

Chapter II outlines the principle of operation of a magnetic surge Front Recorder. It also contains the relevant mathematical base on which the surge front recorder works.

Chapter III deals with the design of the Front and Peak Recorder for effective measurements of the front and the peak of
lightning current. The superiority of ferrite as a material for magnetic links over other permanent magnet materials is emphasized. In the design of the recorder, the identification of the magnetic links with remanence saturation (the maximum remanent magnetism that the link can retain after the removal of the magnetomotive force irrespective of its magnitude) forms the basis. It is a completely new technique used for such an equipment. The resolutions obtained by the device are discussed.

In Chapter IV, the laboratory testing procedure of the device is presented. The results of the testing are compared with those predicted by mathematical relations.

Chapter V presents the details of a prototype of the Front and Peak Recorder assembly proposed to be installed on the tower top or like suitable locations. It also presents the various electrical and mechanical considerations that go into the design of the complete assembly.

Chapter VI highlights the importance of the effective inductance of tower in determining the tower top potential contacted by a lightning surge. A mathematical model for the effective inductance of a single mast steel tower is developed. Based on the model, the computer algorithm is presented and the necessary flow charts are indicated.

The values of effective inductances on various single mast steel towers are computed in Chapter VII by using the mathematical model developed. These results are compared with those obtained by the existing technique and thereby the validity of the mathematical model is established. Useful simplification of the mathematical
model is presented to save precious computer time without any significant loss in the accuracy of results. With the help of this simplified model, computations are carried out on a large number of towers. The results obtained are used to generate a set of characteristic curves which can be used to read the inductance of any tower directly. On the basis of these curves, a very simple empirical formula to find the inductance of any single mast steel tower depending on its height is suggested.

Chapter VIII presents the over-all conclusions arising from the research investigation carried out in this thesis and suggests future course of investigations.

*****
***
*