ABSTRACT

This thesis addresses to the current status of lightning protection, focusing on the external protection with emphasis on the process of interception. Under this approach, three pillars are studied due to their obvious interest in the evaluation and practical application of lightning protection during the first phase, the lightning interception. Those pillars are:

- Laboratory Tests
- Field Tests
- Lightning Protection Models.

These three points can be treated individually; nevertheless, they are interrelated, not only for the technical field they belong to, all together pose an evolution in the magnitude of the electric discharge, starting by the study of the electric discharge in laboratory in order to understand the processes that involves its behavior. It is no possible reproduce the whole event of lightning in laboratory, so field tests are essential to characterize empirically the most important parameters of lightning in natural conditions. The measurements made in natural conditions, are employed to fundament some protection models, furthermore with the statistics, it is possible the definition of the lightning protection levels which determines the practical application of the lightning protection.

The fact of encompassing different points in a technical field is imposed because this thesis has been made in a company specialized in lightning protection, which implies a need of knowledge applied to all the points concerning its scope.

The main contributions of the thesis are collected in each of the chapters and in the proposals made in them, opening new lines of work on which to base a set of techniques and practices that could complement the ones currently applied.

After an introductory chapter, it is treated the main core of the Thesis, composed by the chapters 3, 4 and 5 where the contributions, published by the author are exposed.

In the chapter 3 it is made a revision of the laboratory tests studying the physical processes associated to the electric discharge. At this point and after the review, the author focuses on the U_{50} parameter (amplitude of a pulse voltage in a determined configuration whose application involves a 50% of probability to get a disruptive discharge) using a tool based on neural networks with a configuration of multilayer perceptron (MLP) with which the level of predictability of an individual pulse is evaluated with different configurations, data input and time windows, as indicative of the influence of a variable in the process of generation and interception of the electric arc.

Regarding the field tests, its application typically involves monitoring high-rise structures, the use of rockets for artificial lightning triggering or lightning detection networks. At this point the different measurement strategies are evaluated and a new point of view that could be used to obtain reliable statistics in a short period of time is introduced, which resulted in a paper. The dissertation also introduces a methodology for continuous evaluation of lightning protection systems, comparing the performance of the installed systems and considering also the protection model used for the design of the installation.

About protection models, in a brief introduction the author discusses the different models of protection by extending information about those standardized which, despite their lacks, remain widely used today. After evaluating the current context under standardized lightning protection, it is indicated that one way to complement physically the protection models is the inclusion of methods whose application is consistent with standardized lightning protection models. In this line the author presents a contribution embodied in an article.