Contribution ID: **90** Type: **Poster**

Design and calibration of a 3-D lightning current sensor

Monday, 19 June 2017 13:30 (1h 30m)

During the last three years, a programme of research into studying the lightning impact on a high peak mountain tower has been undertaken at the SIAME Laboratory. Various diagnostics equipment has been mounted near the tower, such as fast speed cameras to capture the arc propagation and capacitive antennas for electric field measurement.
The present paper presents the design and calibration of a current sensor dedicated to this project. The sensor will be used to measure the lightning current flowing through a complex metallic structure. For safety reasons, it was decided to measure the current using inductive techniques and therefore a system using three B-dot probes has been developed.
The research reported includes an experimental parametric study of the dimensions and the positions of the three magnetic probes used as current sensor and the design validation using mathematical computation. The final step of the calibration presented in the paper consists on 3-D magnetic field measurements and their analysis to obtain the lightning current in a Simple Rod Air Terminal (SRAT) during a laboratory test.

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Session Classification: Poster session I - Pulsed Power Physics and Technology, Components and HV Insulation

Track Classification: Pulsed Power Physics and Technology, Components and HV Insulation