Performance study of ferrite core inductor to mitigate lightning indirect effects

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Increase in the use of carbon fiber composites for the construction of aircraft structure and greater dependence on the avionic equipments made from miniaturized solid state devices to perform in-flight critical functions are the recent trends in modern aviation industries [1]. In the light of above mentioned facts, the well being of avionic equipments after lightning stroke is greatly threatened by the transients induced in the internal circuitry, popularly termed as lightning indirect effects. The transient suppressing devices viz. Zener diodes and Metal oxide varistors are not highly reliable as their performance degrades upon the application of each transient surges. E. Cardelli, A. Faba et al. [2] proposed an Inductive Blocking Device (IBD) as a possible solution to be used stand alone or in conjunction with other transient suppressors. The performance of IBD is satisfactory for comparatively slower transients viz. waveform 1, 4, 5 and 6 reported in the standard to verify the compliance requirements of the protection devices [4]. Fast rising waveforms viz. waveform 2 and 3 produces high eddy currents causing the performance of iron core to degrade, which necessitates the use of ferrite core inductors. Ferrite core is suitable for high frequency applications due to their negligible conductivity and high permeability.

This study intends to present the performance analysis of ferrite core inductors to mitigate lightning indirect effects in avionics. The suitable modelling of the ferrite core [5] considering non-linearity and hysteresis is necessary to correctly predict the performance. The simulated results will be verified with the experimental prototype using the lightning pulse generator (see figure 1) present in the laboratory of electromagnetic characterization (CEM) situated at University of Perugia, Terni campus.

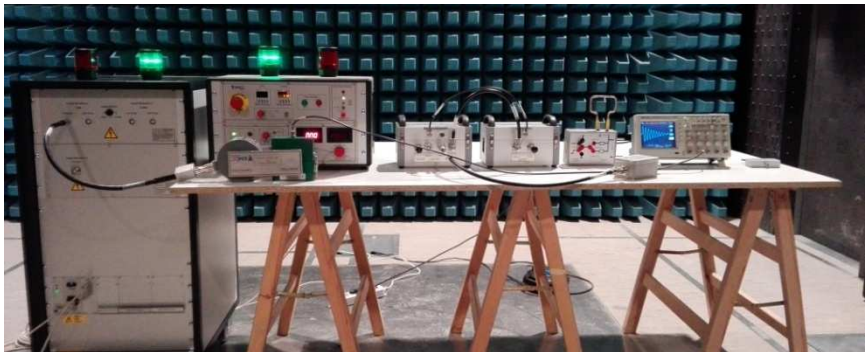

Figure 1. Lightning pulse generator for indirect lightning test in avionic environment.

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[4] J. Urabe, K. Fujii, A. M. B. Harun, Y. Matsumoto and A. Sugiura, "A study of EMI suppression characteristics of ferrite cores," 2006 17th International Zurich Symposium on Electromagnetic Compatibility, Singapore, 2006, pp. 622-625.

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