IEEE TRANSACTIONS ON ELECTROMAGNETIC COMPATIBILITY, VOL. 61, NO. 3, JUNE 2019

EM Fields Generated by a Scale Model Helical Antenna and Its Use in Validating a Code for Lightning-Induced Voltage Calculation.

Massimo Brignone *, Member, IEEE*, Daniele Mestriner *, Student Member, IEEE*, Renato Procopio *, Senior Member, IEEE*, Mansueto Rossi*, Member, IEEE*, Alexandre Piantini *, Senior Member, IEEE*, and Farhad Rachidi *, Fellow, IEEE*

ABSTRACT

This paper aims at validating a code for the evaluation of lightning-induced overvoltages developed in the PSCADEMTDC environment using experimental results obtained on an experimental facility deployed at the University of São Paulo, Brazil that emulates the return stroke channel with a helical antenna. For this reason, suitable expressions for the helix electromagnetic fields are presented and conditions under which they can be approximated with the ones produced by the classical lightning channel model (i.e., a vertical antenna) are derived. Moreover, the analysis of the deviations between measurements and calculations is used as a tool to propose a channel vertical coordinate dependent function for the speed that guarantees the best fitting. The validation is done considering different line configurations, from a single line to a complex layout with one main feeder and many laterals and in the presence of non-linear elements, such as surge arresters.

Index Terms—Lightning electromagnetic pulse, lightning induced effects and protection, lightning location, lightning measurement and modeling.