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An approximation to the Heidler Function with an analytical integral for engineering applications using lightning currents

Terespolsky, Brett Ryan

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UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Abstract

Faculty of Engineering and the Built Environment
School of Electrical and Information Engineering

Master of Science in Engineering

by Brett Ryan Terespolsky

The work presented contributes to research in lightning protection simulations and focuses on approximating the Heidler function with an analytical integral and hence a frequency domain representation. The integral of lightning current models is required in the analysis of lightning events including the induced effects and frequency analyses of lightning strikes. Previous work in this area has produced very specific forms of the Heidler function that are used to represent lightning current waveshapes. This work however focuses on a generic solution with parameters that can be modified to produce any lightning current waveshape that is required. In the research presented, such an approximation is obtained. This function has an analytical solution to the integral and hence can be completely represented in the frequency domain. This allows for a true representation of Maxwell's equations for Electromagnetic (EM) fields and for an analytical frequency domain analysis. It has parameters that can be changed to obtain different waveshapes (10/350, 0.25/100, etc.). The characteristics of the approximation are compared with those of the Heidler function to ascertain whether or not the function is applicable for use with the lightning protection standard (IEC 62305-1). It is shown that the approximation does represent the same characteristics as those of the Heidler function and hence can be used in IEC 62305-1 standardised applications. This represents a valuable contribution to engineers working in the field of lightning protection, specifically simulation models.