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2D Numerical Modeling for Induced Current Distribution in Soil under Lightning Impulse Discharge

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Abstract : Empirical analysis of lightning related phenomena in real time is extremely dangerous due to the relatively high electric discharge involved. Hence, design and optimization of efficient grounding systems depending on real time empirical methods are impeded. Using numerical methods, the dynamics of complex systems could be modeled hence solved as sets of linear and non-linear systems . In this work, the induced current distribution as lightning strike traverses the soil have been numerically modeled in a 2D axial-symmetry and solved using finite element method (FEM) in COMSOL Multiphysics 5.2 AC/DC module. Stratified and non- stratified electrode system were considered in the solved model and soil conductivity (σ) varied between 10 – 58 mS/m. The result discussed therein were the electric field distribution, current distribution and soil ionization phenomena. It can be concluded that the electric field and current distribution is influenced by the injected electric potential and the non-linearity in soil conductivity. The result from numerical calculation also agrees with previously laboratory scale empirical results.

Keywords : current distribution, grounding systems, lightning discharge, numerical model, soil conductivity, soil ionization
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