

Analytical fields expressions due to lightning channel considering variation of return stroke velocities along the lightning channel

ABSTRACT

The return stroke velocity is an important factor for evaluation of lightning electromagnetic fields. Measurements showed that the return stroke velocity is varied at different heights along lightning channel while it is usually entered into field calculations with a constant value in previous studies. This paper presents the analytical electromagnetic fields expressions due to vertical lightning channel where velocity profile along channel is considered. The proposed fields expressions can be used to estimate electromagnetic fields directly in the time domain (without needing to apply any extra conversion to Frequency domain) whereas they are based on Heidler current function and can support widely used engineering current models. Likewise, the proposed field expressions are applied on a typical measured profile of velocity and also a function of velocity profile and the evaluated fields are compared to the corresponding simulated fields based on constant value of velocity and the results are discussed accordingly.

Keyword: Electromagnetic fields; Lightning channel; Return stroke velocity