Numerical and analytical studies of critical radius in Cartesian and spherical geometries for corona discharge in air and \( CO_2 \)-rich environments

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Abstract

In order to determine the most effective geometry of a lightning out, one must first understand the physical phenomena between the corona discharge, Maxwellian; Townsend’s classical theory of sharp tipped rods suggests an increase of local field, while Jurewicz et al. (2006) study of corona discharge as maximum probability of flashover (Jurewicz et al., 2006). In this analysis, the plasma discharge is produced between two electrodes with a high potential difference, resulting in ionization of the interelectrode gap. This process, when done at low current and low temperature can cause a corona discharge, which can be described as a transient arc. The classic corona theory as described by Townsend, theory is actually called to model experimental laboratory results, however, it is adequate in approximating lightning return stroke. In a corona discharge, a number of processes occur simultaneously that result in the ionization of the air. The majority of corona discharge is a result of the discharge and the ionization of the air. This process, when done at low current and low temperature, can cause a corona discharge, which can be described as a transient arc. The classic corona theory as described by Townsend, theory is actually called to model experimental laboratory results, however, it is adequate in approximating lightning return stroke. In a corona discharge, a number of processes occur simultaneously that result in the ionization of the air. The majority of corona discharge is a result of the discharge and the ionization of the air.

I. Introduction

Electron Avalanche

The process of electron avalanche is similar between various types of discharges:
- Initial step of a discharge;
- Release of secondary electrons in electron-neutral collision;
- Secondary discharges electrons with enough \( E \) to repeat the process;
- Avalanche criteria:
  \[ E_0 = 2 \times 10^{14} \text{erg/cm}^3 \]

II. Model Formulation

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A and \( B \) coefficients derived from the experimental fit accurately predict the minimum voltages (Table 2).

III. Results and Discussion

Reference

References

Coauthors

Contributions

Corona Discharge

Electrode discharge around a conductor due to electric field;
Weakly ionized gas responsible for glow at visible wavelengths;
Hypothesized to promote the formation of upward connecting leaders in lightning discharges.

Earth

Spherical E vs. d

Table 1: Experimental coefficients \( Q \) as a function of \( d \) in corona geometry (Engle et al., 2014).