IEEE Access
Multidisciplinary | Rapid Review | Open Access Journal

Received November 23, 2020, accepted December 7, 2020, date of publication December 15, 2020,
date of current version December 30, 2020.

Digital Object Identifier 10.1109/ACCESS.2020.3045073

Fast Corona Discharge Assessment Using FDM integrated With Full Multigrid Method in HVDC Transmission Lines Considering Wind Impact

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This work was supported by the Department of Electrical Engineering and Automation, Aalto University, Espoo, Finland.

ABSTRACT A novel approach for solving the monopolar corona in high voltage direct current (HVDC) transmission line systems is proposed by the finite difference method (FDM) and a full multigrid method (FMG). Specifically, the FMG is implemented as a fast solver with respect to existing iterative solutions for the FDM to solve the Poisson equation, particularly on fine grids. The advantage features of the proposed approach are that it avoids the hypothesis of a constant electric field around the conductor's surface. Further, it considers the influence of space charge on both the magnitude and the direction of the electrical field. The proposed approach is employed for computing the electric field and current density on the ground plane with and without wind effect. Considering the impact of wind in the present study, the findings confirm that both corona current density and electric field on the ground plane are influenced by the transverse wave. Eventually, the effect of changing the wind speed on the electric field profiles and the current density is deeply studied in HVDC transmission line systems. To prove the efficacy of the proposed approach, it is compared with previous experimental results where a better agreement is reached rather than other numerical techniques.

INDEX TERMS HVDC transmission line, finite difference method, full multigrid method, corona discharge, wind impact.

I. INTRODUCTION

With the huge increase in power transmitted over long distances, high voltage direct current (HVDC) transmission has become emulative, and many HVDC transmission lines have been built around the world [1], [2]. HVDC transmission the study of corona discharges on HVDC transmission lines.

In HVDC transmission systems, corona generates space charges that fill the region between the electrodes. However, in high voltage alternating current (HVAC) transmis-