THE INFLUENCE OF CORONA DISCHARGE ON THE LIGHTNING SURGE PROPAGATION ALONG THE TRANSMISSION LINES

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Abstract. Atmospheric discharges are one of the most significant cause of failures of the energy distribution system (see Hileman 1999). Overvoltages caused by lightning strokes travel along transmission lines and they can reach substations where installed equipment is particularly sensitive to pulse amplitude and steepness. When the lightning overvoltage is generated on the transmission line, surge wave starts to travel along the overhead wires. Corona discharge around the wire is the main effect that has influence on the change of surge pulse during propagation and must be taken into account when designing surge protection. For corona discharge simulations drift-diffusion model is used for describing the particle dynamics by four continuity equations for electrons, positive ions and O_2^- and O^- negative ions (see Ignjatovic and Cvetic 2021). This model enables a detailed analysis of the temporal evolution and spatial dependence of the concentration of particles during the discharge. Result for the total generated corona charge is used to simulate the propagation of the surge wave along the overhead wire. Validity of the model is checked by the comparison with the results of experiments performed by Cooray and Noda. The corona model should be simple and without need for complex mathematical calculations in order to be applicable in wider engineering practice. On the other hand to achieve an accurate estimate of the electrical charge generated during the corona discharge, it is necessary to take account a variety of physical processes. Using more computationally demanding models is justified in order to discover new conclusions about corona discharge process that can be used to formulate simpler models.

References

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