

Optimal design of corona ring for 132 kV insulator at high voltage transmission lines based on optimisation techniques

ABSTRACT

The installation of a corona ring on an insulator string on a transmission line is one of the solutions to reduce the electric field stress surrounding the energised end of the insulator string. However, installing a corona ring with an optimum design to reduce the electric field magnitude on an insulator string is a challenging task. Therefore, in this work, a method to achieve the optimum design of a corona ring for 132 kV composite non-ceramic insulator string was proposed using two optimisation methods: the Imperialist Competitive Algorithm (ICA) and Grey Wolf Optimisation (GWO). A composite non-ceramic insulator string geometry with and without a corona ring was modelled in finite element analysis and used to obtain the electric field distribution in the model geometry. The electric field distribution was evaluated using a variation in the corona ring's dimensions, i.e., the ring diameter, the ring tube diameter and the vertical position of the ring along the insulator string. From the results achieved, a comparison of the minimum electric field magnitude along the insulator string with a corona ring design shows that the minimum electric field magnitude is found to be lower using optimisation techniques compared to without using optimisation techniques by between 3.724% and 3.827%. Hence, this indicates the capability and effectiveness of the proposed methods in achieving the optimum design of a corona ring on an insulator string.