Influence of Voltage Type and Polarity on Electric Field Distribution Along a Polymeric Insulator

Arshad[1], Dr. A. Nekahi[1], Professor S. McMeekin[1], Professor M. Farzaneh[2]

[1]School of Engineering and Built Environment, Glasgow Caledonian University, United Kingdom

[2]2Canada Research Chair on Atmospheric Icing Engineering of Power Networks (INGIVRE), Université du Québec à Chicoutimi, QC, Canada

Abstract

During the last few decades, polymeric insulators are extensively used for AC power transmission and distribution. With the increase interest in HVDC in recent years, polymeric insulators are considered potential solution for HVDC power transmission. Electric field distribution along a polymeric insulator surface under contaminated conditions is considered one of the important parameter for performance evaluation. This paper addresses the effect of voltage type and polarity on the electric field and potential distribution along a standard polymeric insulator. A standard 33 kV polymeric insulator was be used for simulations, and electric field distribution at AC, DC+ and DC- were calculated. The polymeric insulator consists of a metal end fitting, Fibre Reinforced Plastic (FRP) as a load bearing structure, and silicone rubber is used as for weather sheds. The insulator used for simulation is shown in Fig. 1. Finite element numerical model was used in COMSOL Multiphysics software to calculate electric field and potential distribution along the insulator. Electric field and potential distribution along a standard polymeric insulator is discussed in this paper at AC, DC+ and DC- applied voltage. Effect of pollution severity is also investigated by applying a 2-mm pollution layer on the insulator surface.

The results of this work will augment our knowledge regarding electric field and potential distribution along a standard polymeric insulator for AC and DC applications. It will also help engineers, scientists and utility companies in the selection of insulator for polluted conditions.

Reference

[1] B. Marungsri, W. Onchantuek, and A. Oonsivilai. "Electric field and potential distributions along surface of silicone rubber polymer insulators using finite element method." Proceedings of World Academy of Science: Engineering & Technology (2008).

[2] M. Ghassemi, M. Farzaneh, W. A. Chisholm, and J. Beattie. "Potential and electric field calculation along a FRP live-line tool under cold and icing conditions." In Electrical Insulation Conference (EIC), 2014, pp. 218-222. IEEE, 2014.

[3] Arshad, A. Nekahi, S.G. McMeekin, and M. Farzaneh, “Effect of Pollution Severity on Electric Field Distribution along a Polymeric Insulator”, 11th International Conference on the Properties and Applications of Dielectric Materials (ICPADM) 2015. (in press)

[4] Arshad, A. Nekahi, S. G. McMeekin, and M. Farzaneh, “Effect of Dry Band Location on Electric Field Distribution along a Polymeric Insulator under Contaminated Conditions”, 50th University Power Engineering Conference, Staffordshire United Kingdom, 2015. (Accepted)

Figures used in the abstract

Figure 1: 33 kV Polymeric Insulator

Figure 2

Figure 3

Figure 4