World Academy of Science, Engineering and Technology
International Journal of Electrical and Computer Engineering
Vol:16, No:04, 2022

Investigating The Effect Of Convection On The Rating Of Buried Cables Using The Finite Element Method

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Abstract : The heat transfer coefficient at the soil–air interface is important in calculating underground cable ampacity when convection occurs. Calculating the heat transfer coefficient accurately is complex because of the temperature variations at the earth's surface. This paper presents the effect of convection heat flow across the ground surface on the rating of three single-core, 132kV, XLPE cables buried underground. The Finite element method (FEM) is a numerical analysis technique used to determine the cable rating of buried cables under installation conditions that are difficult to support when using the analytical method. This study demonstrates the use of FEM to investigate the effect of convection on the rating ofburied cables in flat formation using QuickField finite element simulation software. As a result, developing a model to simulate this type of situation necessitates important considerations such as the following boundary conditions: burial depth, soil thermal resistivity, and soil temperature, which play an important role in the simulation's accuracy and reliability. The results show that when the ground surface is taken as a convection interface, the conductor temperature rises and may exceed the maximum permissible temperature when rated current flows. This is because the ground surface acts as a convection interface between the soil and the air (fluid). This result correlates and is compared with the rating obtained using the IEC60287 analytical method, which is based on the condition that the ground surface is an isotherm.

Keywords : finite element method, convection, buried cables, steady-state rating
Conference Title : ICHVET 2022 : International Conference on High Voltage Engineering and Testing
Conference Location : Cape Town, South Africa
Conference Dates : April 14-15, 2022

Open Science Index, Electrical and Computer Engineering Vol:16, No:04, 2022 publications.waset.org/abstracts/147448.pdf