6TH INTERNATIONAL CONFERENCE ON APPLIED RESEARCH IN COMPUTER, ELECTRICAL AND INFORMATION TECHNOLOGY
March 6, 2022
Tbilisi - Georgia
CINVU
Kosar University
Avicenna International Community College LLC

Selection of electric flashover parameters based on particle swarm optimization algorithm

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Abstract

Electric arc furnace (EAF) is a typical nonlinear load in power system, which has serious effects on electric energy quality. In this thesis, a new method of EAF modeling is proposed, and a mixed three-phase model is set up. Based on the heat principles of arcs, load random fluctuation is added to this model, thus the model could reflect the effect on harmonics, voltage fluctuation, and three-phase unbalance. One of the most important problems in high pressure insulators is its surface sparks due to pollution. The electric discharge on the contaminated insulator is generally when the surface of the insulator is wet, due to fog and dew or rain. An electric flashover phenomenon is a condition of electric discharge in the air or other environments that are usually non-conductor. An electric flashover is generated when the electricity flow is transmitted through the air between two conductors that are not directly in contact. This flashover depends on the voltage, electrical conductivity of the environment and the distance between two conductors. The electrical flashover in contaminated insulators has not been reported through a precise mathematical model yet. The main problem is the definition of flashover constants, which occurs in dry bands and rising voltage more than critical value. In this study, a particle swarm algorithm optimization (PSO) has been proposed for determination of flashover constants which is simulated by using results and laboratory values obtained from artificial insulators in various papers. First, Obenhaus's well-known model for occurs flashovers in contaminated insulators has been used. Using the PSO algorithm allows the definition of flashover constants and then calculates the critical voltage under conditions of salinity and surface conductivity and compared with the results obtained with the previous methods.

Keywords: insulator, Electrical discharge, Electrical flashover, Mathematical model, Obenhaus, Contaminated insulators, Flashover constants, Critical voltage