Stochastic Modelling of Electrical Tree Progression in Modern High Voltage Power Cables

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Abstract

A complete theoretical model of pre-breakdown phenomenon in indoor polymeric insulators is demonstrated. It has been observed that occurrence of breakdown in solid dielectrics is mainly due to the progression of electrical treeing which is eventually generated due to localized field enhancement and partial discharge activity. A methodical analysis of tree propagation in XLPE cables is performed by adopting two dimensional stochastic simulations. The major advantage behind this model is that it inherently exhibits parallel processing by considerably reducing the computation time. It has been observed that when the probability of the electric field at the needle plane exceeds the critical electric field the material degrades due to the inception of fine filamentary tree channels. Using standard needle plane geometries, two main types of tree structures, bush type and branch type trees were simulated. Fractal dimensions of the simulated electrical trees were being accurately computed. Failure analysis of electrical trees is investigated by adopting Weibull – distribution studies.

References
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Index Terms

Computer Science
Power Electronics
Keywords

Partial Discharge (PD), Electrical Breakdown, XLPE, Correlation Constant, Stochastic Model, Weibull Distribution