

One method for condition assessment of electrical equipment

After opening up the electricity markets to more competition the transmission system operators experience an increasing pressure of costs. Hence they are forced to make use of all possible economy measures. In order to reduce the costs in the field of maintenance activities the transmission system operators establish an asset management system. Software support is essential when setting up an asset management system. There is an integrated system for maintenance scheduling which optimizes the point in time when necessary maintenance actions have to be carried out considering system specific constraints. This system uses the type of maintenance actions, their duration and the allowed maintenance period as input data which are determined on the basis of intelligent condition assessment of the equipment. For the purpose of condition assessment substantial input data is necessary and available. This thesis presents an approach to condition assessment based on Dempster-Shafer's theory of evidence which can be regarded as generalization of Bayesian theory of probability. Different possible diagnoses are modeled by Markov trees and it is shown how to propagate evidence using Markov trees.

By way of example a power transformer is used to show the application of the system. Power transformers are expensive devices outfitted with substantial protection and monitoring equipment. The qualitative relationship between primary information and possible diagnoses is modeled by a Markov tree. The quantitative relationship is modeled by basic probability assignments which map the value of the input data to mass numbers used by theory of evidence. After processing all input data the correct diagnosis can be determined. The allowed maintenance period is calculated by extrapolation of the characteristics of the degree of belief as a function of time. An extension of the system considers the age of primary information. Recent information are given a greater weighting than older information. As a result it is possible to detect a lack of primary information and cause e. g. visual inspections to be done. Finally a complete model of a power transformer is given. In order to verify the system the results of dissolved gas analyses of three different power transformers are used to determine the correct one of six possible diagnoses.

Keywords

electric power system, transmission network, system operator, asset management, maintenance, theory of evidence, Markov tree, condition assessment, power transformer, dissolved gas analysis