Available online at www.sciencedirect.com
ScienceDirect
Procedia Computer Science 107 (2017) 231 – 235
Procedia Computer Science

International Congress of Information and Communication Technology (ICICT 2017)

Real-time Evaluation Model of Power Line Fault Probability based on Multiple Meteorological factors

Cao Yongxing[a], Zhao Yufang[b], Zhao Hongyu[b,*]

[a]*State Grid Sichuan Electric Power Research Institute，Chengdu 610072, China*
[b]*Beijing Guowang Fuda Science and Technology Development Co., Ltd., Beijing 100070, China*
**Corresponding authors: asas.014@163.com*

Abstract

In this paper we study the power line fault probability considering various meteorological factors. The calculation of the real-time fault probability of transmission lines is an important part of on-line risk assessment and real-time reliability calculation of power system. First, we study the fuzzy member function of various factors. Uncertainty theory is adopted to determine the weight coefficient of each layer, combined with fuzzy evaluation method. Second we collect actual data to simulate the model. The quantitative model of each monitoring quantity is established. Finally, We verified our model in actual weather data and power line malfunction probability data. The experimental results show that the proposed method is effective and promising in prevent such incident.

Keywords: Fuzzy function, meteorological analysis, power line fault probability;

1. Introduction

Power line fault prediction is an interesting topic in mathematical modeling and it is critical for personal safety[1,2,3]

Ice disaster has a long period of progressive process, for which the short-term forecast is easier, and the long-term forecast is more difficult. Owing to equipment concentration and good de-icing conditions, plant equipment in the station is affected smaller than the wire outdoor by the ice. But the ice disaster may reduce the actual usable generation capacity by affecting fuel transport. The tower is the main equipment damaged in the ice disaster. Deterioration of the external environment in the short term can be restored. But restoring transmission is very

Peer-review under responsibility of the scientific committee of the 7th International Congress of Information and Communication Technology
doi:10.1016/j.procs.2017.03.084

difficult if the tower collapses. So active disconnection is a kind of corrective control measures under extreme ice disaster when it is necessary[4,5].

After the ice attached to wire exceeds the designed thickness, the mechanical failure and electrical failure may occur due to the increase of icing quality and wind pressure area[6,7]. Mechanical accidents consist of metal damage, broken wire, insulator string flip or crack, foundation sinking, tower damage, etc.

At present, the research on transmission line fault probability mainly involves reliability assessment (weather-related), operation state assessment, risk assessment (considering weather) and maintenance risk analysis model of transmission line probability is based on historical statistics, which can not reflect the transmission line operating conditions, changes in the surrounding environment and other factors, and cannot meet the online security monitoring and security control needs. This paper presents a real-time fault probability evaluation method for overhead transmission lines with meteorological factors.

2. Real-time Fault Model

The real-time fault probability of the transmission line is closely related to the real-time status of the insulators, conductors, lightning arrester, tower and earth wire. Each component can monitor some real-time status. The real is the basis for evaluating the real-time fault probability of transmission lines.

It is generally not possible to transmission line insulators, conductors, lightning arrester, tower and earth wire, so it is only necessary to select a number of monitoring points on the transmission line (if a transmission tower is long). Monitoring results of each monitoring point can only be characterized by the monitoring points associated with the tower and directly connected to the line running. In this paper, the failure rate of the real-time monitoring data of each monitoring point is firstly evaluated (the data of the components with the lowest score) for each monitoring point. Then the evaluation results of each monitoring point are fused.

The idea of calculating the real-time fault probability of the i-th on-line monitoring point of a transmission line is as follows. According to the historical data and the specification of the transmission line, the quantization model of each on-line monitoring data is established respectively. Then the unascertained rational number method, taking full account of the authority of experts and the difference of judgment results, the weights of each index are determined, and finally, the fuzzy real-time health probability values of the i-th on-line monitoring points are normalized by the fuzzy hierarchy comprehensive evaluation method , and calculate the real-time fault probability value of the transmission line.

3. Fuzzy Member Function

At first, the input parameters are fuzzified. The parameters of wind excitation are covered by six fuzzy subsets: wind excitation is small (Evs), wind excitation is small (Es), wind excitation is medium (Em), wind excitation is large (El), wind excitation is large (Evl), the wind excitation is very large (Eel). The distribution is shown in Fig.1.

The range of line parameters is covered by four fuzzy subsets of the line parameters. Line parameter is small (Ls), line parameter is medium (Lm), line parameter is large (Ll), line parameter is very big (Lvl), its distribution is shown in Fig.1.

The output of the fuzzy mathematical model is the failure rate u, with seven fuzzy subsets covering its range [0,1]: Very small (ES), very small (VS), small (S), medium (M), large (L), large (VL), very large (EL). The distribution of membership function is shown in Fig.1.