

Review

# Review on Artificial Intelligence-Based Fault Location Methods in Power Distribution Networks

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**Abstract:** This paper provides a comprehensive and systematic review of fault localization methods based on artificial intelligence (AI) in power distribution networks described in the literature. The review is organized into several sections that cover different aspects of the methods proposed. It first discusses the advantages and disadvantages of various techniques used, including neural networks, fuzzy logic, and reinforcement learning. The paper then compares the types of input and output data generated by these algorithms. The review also analyzes the data-gathering systems, including the sensors and measurement equipment used to collect data for fault diagnosis. In addition, it discusses fault type and DG considerations, which, together with the data-gathering systems, determine the applicability range of the methods. Finally, the paper concludes with a discussion of future trends and research gaps in the field of AI-based fault location methods. Highlighting the advantages, limitations, and requirements of current AI-based methods, this review can serve the researchers working in the field of fault location in power systems to select the most appropriate method based on their distribution system and requirements, and to identify the key areas for future research.

**Keywords:** fault location; artificial intelligence; power distribution networks



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## 1. Introduction

Following to a short-circuit fault in distribution networks, the fault should be located and isolated before restoring the supply. A fast and accurate fault location method can help to improve the continuity of supply considerably. In general, the distribution-network fault location methods can be categorized into impedance-based methods, state estimation-based methods, traveling wave-based methods, and artificial intelligence-based (AI-based) methods.

The impedance-based methods determine the location of faults by measuring the apparent impedance seen from one or more measurement points. These methods estimate the fault location by comparing the measured impedance for the probable fault paths in the network with the measured one [1–5]. These methods can provide fault location estimations with acceptable accuracy, although they might estimate several candidate locations in the networks with several laterals. They require detailed data about the network topology, line impedances, and loads and are, hence, very sensitive to network-model inaccuracies.

State estimation-based methods consider a fault as bad data and try to locate it using the data collected from different measurement points of the network [6–8]. Similar to the impedance-based methods, these techniques need the distribution-network data. While they are less sensitive to input data inaccuracies, they can only be applied to networks with considerable measurement infrastructures.

Traveling wave-based methods estimate the fault location by calculating the sweep duration of the wave traveling from the measurement point to the fault location [9–12].

# Review Of Fault Location Methods For Distribution Power System

**John R. Dunlap**



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**Artificial Intelligence Applications in Electrical Transmission and Distribution Systems Protection** Almoataz Y. Abdelaziz, Shady Hossam Eldeen Abdel Aleem, Anamika Yadav, 2021-10-21 Artificial intelligence AI can successfully help in solving real world problems in power transmission and distribution systems because AI based schemes are fast adaptive and robust and are applicable without any knowledge of the system parameters This book considers the application of AI methods for the protection of different types and topologies of transmission and distribution lines It explains the latest pattern recognition based methods as applicable to detection classification and location of a fault in the transmission and distribution lines and to manage smart power systems including all the pertinent aspects FEATURES Provides essential insight on uses of different AI techniques for pattern recognition classification prediction and estimation exclusive to power system protection issues Presents an introduction to enhanced electricity system analysis using decision making tools Covers AI applications in different protective relaying functions Discusses issues and challenges in the protection of transmission and distribution systems Includes a dedicated chapter on case studies and applications This book is aimed at graduate students researchers and professionals in electrical power system protection stability and smart grids

**Power System Fault Diagnosis** Md Shafiullah, M. A. Abido, A. H. Al-Mohammed, 2022-01-14 Power System Fault Diagnosis A Wide Area Measurement Based Intelligent Approach is a comprehensive overview of the growing interests in efficient diagnosis of power system faults to reduce outage duration and revenue losses by expediting the restoration process This book illustrates intelligent fault diagnosis schemes for power system networks at both transmission and distribution levels using data acquired from phasor measurement units It presents the power grid modeling fault modeling feature extraction processes and various fault diagnosis techniques including artificial intelligence techniques in steps The book also incorporates uncertainty associated with line parameters fault information resistance and inception angle load demand renewable energy generation and measurement noises Provides step by step modeling of power system networks distribution and transmission and faults in MATLAB SIMULINK and real time digital simulator RTDS platforms Presents feature extraction processes using advanced signal processing techniques discrete wavelet and Stockwell transforms and an easy to understand optimal feature selection method Illustrates comprehensive

results in the graphical and tabular formats that can be easily reproduced by beginners Highlights various utility practices for fault location in transmission networks distribution systems and underground cables

**Special Technical Conference: Underground Residential Distribution. Advance Proceedings of the Underground Residential Distribution Conference, St. Louis, M., April 21-23, 1964. Sponsored Jointly by IEEE Insulated Conductors and Transmission and Distribution Committees** Institute of Electrical and Electronics Engineers,1964 *Transactions of the American Institute of Electrical Engineers* American Institute of Electrical Engineers,1963

**Eighth IEE International Conference on Developments in Power System Protection, 5-8 April, 2004, RAI Centre, Amsterdam, The Netherlands ,2004**

**The Electrical Review ,1929** **IEEE/PES Transmission and Distribution Conference and Exhibition 2002: Asia Pacific ,2002** Engineering Magazine ,1912 **Industrial Management** John R. Dunlap,1910 Transactions of the American Institute of Electrical Engineers American Institute of Electrical Engineers,1924 List of members in v 7 15 17 19 20 *Proceedings of the Institution of Electrical Engineers* Institution of Electrical Engineers,1930 Vols 56 61 accompanied by Institution notes no 1 40 Dec 1917 Oct 1923 v 10 and 57 each accompanied by a suppl other vols accompanied by special issues and supplements

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**Power Distribution Conference ,1992** *Applied Science & Technology Index ,1996* **SIRA Abstracts and Reviews ,1966** **Electric Energy Conference, Sydney, 13-17 October, 1980** Institution of Engineers Australia. National Committee on Electric Power Engineering,1980 The theme of the Conference is Distribution and Utilisation of Electric Energy The aim of the Conference is to advance practice and knowledge in the areas of distribution and utilisation of electric energy and to provide a venue for exchanges of experience and ideas between engineers from throughout Asia and the Pacific Regions

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