Simple and efficient method for load flow solution of radial distribution networks

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The paper presents a simple and efficient method for solving radial distribution networks. The proposed method involves only the evaluation of a simple algebraic expression of voltage magnitudes and no trigonometric functions as opposed to the standard load flow case. Thus, computationally the proposed method is very efficient and it requires less computer memory. The proposed method can easily handle different types of load characteristics. Several Indian rural distribution networks have been successfully solved by using the proposed method.

Keywords: distribution load flow, mathematical techniques, radial networks

I. Nomenclature

NN	total number of nodes
$LN1$	total number of branches ($LN1 = NB-1$)
$PL(i)$	real power load of ith node
$QL(i)$	reactive power load of ith node
$|V(i)|$	voltage magnitude of ith node
$R(j)$	resistance of jth branch
$X(j)$	reactance of jth branch
$I(j)$	current flowing through branch j
$P(m2)$	total real power load fed through node $m2$
$Q(m2)$	total reactive power load fed through node $m2$

$\delta(m2)$	voltage angle of node $m2$
$LP(j)$	real power loss of branch j
$LQ(j)$	reactive power loss of branch j
$IS(j)$	sending-end node of branch j
$IR(j)$	receiving-end node of branch j
$PLOSS$	total real power loss
$QLOSS$	total reactive power loss

II. Introduction

Load flow analysis of distribution systems has not received much attention unlike load flow analysis of transmission systems. However, some work has been carried out on load flow analysis of a distribution network but the choice of a solution method for a practical system is often difficult. Generally distribution networks are radial and the R/X ratio is very high.

Because of this, distribution networks are ill-conditioned, and conventional Newton Raphson (NR) and fast decoupled load flow (FDLF) methods[1-3] are inefficient in solving such networks.

Many researchers[4-7] have suggested modified versions of the conventional load flow methods for solving ill-conditioned power networks.

Recently researchers have paid much attention to obtaining the solution of distribution networks.

Kersting and Mendive[8] and Kersting[9] have presented a load flow technique based on the ladder network theory and it appears to work very well. Shirmohammadi et al.[10] have presented a compensation-based power flow

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applicationaspectsofECandhasservedasanimportantlink between EC research and its application in a variety of domains During these ten years new workshops have arisen some have disappeared while others have matured to become conferences of their own such as EuroGP in 2000 EvoCOP in 2004 and EvoBIO last year **Application of Soft Computing and Intelligent Methods in Geophysics** Alireza Hajian,Peter Styles,2018-06-21 This book provides a practical guide to applying soft computing methods to interpret geophysical data It discusses the design of neural networks with Matlab for geophysical data as well as fuzzy logic and neuro fuzzy concepts and their applications In addition it describes genetic algorithms for the automatic and or intelligent processing and interpretation of geophysical data *The Fundamentals of Computational Intelligence: System Approach* Mikhail Z. Zgurovsky,Yuriy P. Zaychenko,2016-07-01 This monograph is dedicated to the systematic presentation of main trends technologies and methods of computational intelligence CI The book pays big attention to novel important CI technology fuzzy logic FL systems and fuzzy neural networks FNN Different FNN including new class of FNN cascade neo fuzzy neural networks are considered and their training algorithms are described and analyzed The applications of FNN to the forecast in macroeconomics and at stock markets are examined The book presents the problem of portfolio optimization under uncertainty the novel theory of fuzzy portfolio optimization free of drawbacks of classical model of Markovitz as well as an application for portfolios optimization at Ukrainian Russian and American stock exchanges The book also presents the problem of corporations bankruptcy risk forecasting under incomplete and fuzzy information as well as new methods based on fuzzy sets theory and fuzzy neural networks and results of their application for bankruptcy risk forecasting are presented and compared with Altman method This monograph also focuses on an inductive modeling method of self organization the so called Group Method of Data Handling GMDH which enables to construct the structure of forecasting models almost automatically The results of experimental investigations of GMDH for forecasting at stock exchanges are presented The final chapters are devoted to theory and applications of evolutionary modeling EM and genetic algorithms The distinguishing feature of this monograph is a great number of practical examples of CI technologies and methods application for solution of real problems in technology economy and financial sphere in particular forecasting classification pattern recognition portfolio optimization bankruptcy risk prediction under uncertainty which were developed by authors and published in this book for the first time All CI methods and algorithms are presented from the general system approach and analysis of their properties advantages and drawbacks that enables practitioners to choose the most adequate method for their own problems solution **Optimization Methods in Manufacturing Processes** Anand J. Kulkarni,2025-08-05 This book presents the result of an innovative challenge to create a systematic literature overview driven by machine generated content Questions and related keywords were prepared for the machine to query discover collate and structure by Artificial Intelligence AI clustering The AI based approach seemed especially suitable to provide an innovative perspective as the topics are indeed both complex

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Machine Learning Perspectives of Agent-Based Models Pedro Campos,Anand Rao,Joaquim Margarido,2025-09-19 This book provides an overview of agent based modeling ABM and multi agent systems MAS emphasizing their significance in understanding complex economic systems with a special focus on the emerging properties of heterogeneous agents that cannot be deduced from the characteristics of individual agents ABM is highlighted as a powerful tool for studying economics especially in the context of financial crises and pandemics where traditional models such as dynamic stochastic general equilibrium DSGE models have proven inadequate Containing numerous practical examples and applications with R Python Julia and Netlogo the book explores how learning particularly machine learning can be integrated into multi agent systems to enhance the adaptation and behavior of agents in dynamic environments It compares different learning approaches including game theory and artificial intelligence highlighting the advantages of each in modeling economic phenomena **A fault detection method for FADS system based on interval-valued neutrosophic sets, belief rule base, and D-S evidence reasoning** Qianlei Jia,Jiayue Hu,Weiguo Zhang, Fault detection with the characteristics of strong uncertainty and randomness has always been one of the research hotspots in the field of aerospace Considering that devices will inevitably encounter various unknown interference in the process of use which greatly limits the performance of many traditional fault detection methods Therefore the main aim of this paper is to address this problem from the perspective of uncertainty and randomness of measurement signal In information engineering interval valued neutrosophic sets IVNSs belief rule base BRB and Dempster Shafer D S evidence reasoning are always characterized by the strong ability in revealing uncertainty but each has its drawbacks As a result the three theories are firstly combined in this paper to form a powerful fault detection algorithm Besides a series of innovations are proposed to improve the method including a new score function based on p norm for IVNSs and a new approach of calculating the similarity between IVNSs which are both proved by authoritative prerequisites To illustrate the effectiveness of the proposed method flush air data sensing FADS a technologically advanced airborne sensor is adopted in this paper The aerodynamic model of FADS is analyzed in detail using knowledge of aerodynamics under subsonic and supersonic conditions meanwhile the high precision model is established based on the aerodynamic database obtained from CFD software *Information Systems for Intelligent Systems* Andres Iglesias,Jungpil Shin,Bharat Patel,Amit Joshi,2025-05-30 This book includes selected papers presented at World Conference on Information Systems for Business Management ISBM 2024 held in Bangkok Thailand during September 12 13 2024 It covers up to date cutting edge research on data science information systems infrastructure and computational systems engineering systems business information systems and smart secure systems Applied Mechanics Reviews ,1977 **Clinical Diagnosis by Laboratory Methods** James Campbell Todd,Arthur Hawley Sanford,1927 **Water-resources Activities of the U.S. Geological Survey in Illinois** Geological Survey (U.S.),1993 Cognitive Computation and Systems Bin Xu,Jianlong Qiu,2025-07-21 This book constitutes the refereed proceedings of the Third International Conference on Cognitive

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