

1. Record Nr.	UNINA9910553067703321
Autore	Dong Xinzhou
Titolo	The theory of fault travel waves and its application // Xinzhou Dong
Pubbl/distr/stampa	Singapore : , : Springer, , [2022] ©2022
ISBN	9789811904042 9789811904035
Descrizione fisica	1 online resource (745 pages)
Disciplina	621.3104
Soggetti	Electric fault location - Data processing Short circuits
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di bibliografia	Includes bibliographical references.
Nota di contenuto	Intro -- Foreword by Jiali He -- Foreword by Yaozhong Ge -- Foreword by Qixun Yang -- Preamble -- Contents -- 1 Introduction -- 1.1 Power Systems and Faults -- 1.2 Power System Failure Analysis -- 1.2.1 Kirchhoff's Law -- 1.2.2 Nodal Voltage and Loop Current Methods -- 1.2.3 Symmetric Component Method -- 1.2.4 Laplace Transform Method -- 1.2.5 Shortcomings of Existing Power System Fault Analysis -- 1.3 Challenges to Traditional Protective Relaying and Fault Detection Techniques -- 1.3.1 Transmission Line Split-Phase Current Differential Protection -- 1.3.2 Flexible DC Grid Protection -- 1.3.3 Single-Phase Grounding Protection for Distribution Lines in Neutral Point Noneffective Grounding Systems -- 1.3.4 Power Line Fault Location -- 2 Fundamentals of Electromagnetic Waves -- 2.1 Time-Varying Electromagnetic Fields -- 2.1.1 Maxwell's Equations -- 2.1.2 Poynting's Theorem -- 2.2 Wave Equations and Their D'Alembert Solutions -- 2.2.1 Wave Equations for the Electromagnetic Field -- 2.2.2 Dynamic Potentials -- 2.2.3 D'Alembert Solutions of the Wave Equation -- 2.3 Planar Electromagnetic Waves -- 2.3.1 Uniform Plane Waves in an Ideal Medium -- 2.3.2 Uniform Plane Waves in a Conductive Medium -- 2.3.3 Reflection of Electromagnetic Waves at the Interface of Different Media -- 2.4 Guided Electromagnetic Waves in Homogeneous Transmission Lines -- 2.4.1 Basic Equations for a Homogeneous

Transmission Line -- 2.4.2 Sinusoidal Steady-State Solutions of the Uniform Transmission Line Equation -- 2.4.3 Equivalent Circuits and Operating States for Uniform Transmission Lines -- 2.5 Guided Electromagnetic Waves in Parallel Multiconductor Lines -- 2.5.1 Wave Equations for Parallel Multiconductor Lines -- 2.5.2 Phase-Modal Transformation of Parallel Multiconductor Lines -- 2.5.3 Wave Impedance and Wave Velocity on a Parallel Multiconductor Line Modulus.

3 Fault Traveling Wave Theory -- 3.1 Fault Traveling Waves in Single-Phase Uniform Lossless Lines -- 3.1.1 Generation of Fault Traveling Waves -- 3.1.2 Fluctuation Equation for a Single Conductor Line -- 3.2 Fault Traveling Waves in Three-Phase Transmission Lines -- 3.2.1 Phase Mode Transformation -- 3.2.2 Composite Modulus Network -- 3.3 Traveling Wave Phenomena at Nominal Frequency -- 3.3.1 Line Wave Decomposition -- 3.3.2 Folded Reflection Phenomena of Traveling Waves -- 3.4 Status of Research on the Fault Traveling Wave Problem -- 3.5 Transient Solutions for Fault Traveling Waves Without Considering the Parameter-Dependent Frequency Characteristics -- 3.5.1 Basic Idea of the Grid Method for Solving Fault Traveling Waves [17] -- 3.5.2 Analysis of Faulted Traveling Wave Sources -- 3.5.3 Initial Traveling Waves for Different Traveling Wave Source Moduli -- 3.5.4 Representation of Power Networks -- 3.5.5 Reflection of Traveling Waves at Each Node -- 3.5.6 Fault Traveling Wave Resolution Calculation Method-Frequency Domain Method -- 3.6 Faulted Traveling Wave Transient Solutions Considering Parametric-Dependent Frequency Characteristics [17] -- 3.6.1 Complex Frequency Domain Solutions of the Fluctuation Equations for Parallel Multiconductor Lines -- 3.6.2 Selection of the Fitting Function for Traveling Waves Under Frequency-Dependent Characteristics -- 3.6.3 Acquisition of Parameters -- 3.7 Fault Steady-State Calculations -- 3.8 Computer Implementation of Fault Traveling Wave Transient Solutions -- 3.8.1 Representation and Storage of Power Networks -- 3.8.2 Network Changes After a Failure -- 3.8.3 Generation Method for Traveling Wave Propagation Paths -- 3.8.4 Calculation of Fault Traveling Waves -- 3.8.5 Analysis of Algorithms -- 3.9 Instantaneous Reactive Power Theory and Fault Direction Characteristics. 3.9.1 Overview of Instantaneous Reactive Power Theory -- 3.9.2 Definition of Instantaneous Reactive Power Based on the Hilbert Transform -- 3.9.3 Fault Direction Characteristics of Reactive Power Under the Hilbert Transform [16] -- 3.10 Faulty Traveling Wave Characteristics for Various Fault Types -- 4 Wavelet Transform and Its Application to Fault Traveling Wave Analysis -- 4.1 Basic Concepts -- 4.1.1 History of Wavelet Analysis and Overview of Its Applications -- 4.1.2 Time-Frequency Localized Representation of the Signal -- 4.1.3 Continuous Wavelet Transform -- 4.1.4 Time-Frequency Localization Performance of Wavelet Transform -- 4.1.5 Two Important Types of Wavelet Transforms -- 4.1.6 Wavelet Representation of the Signal -- 4.2 Discrete Wavelet Transform -- 4.2.1 Discrete Wavelets and Discrete Wavelet Transforms -- 4.2.2 Multiresolution Analysis with Scale Functions -- 4.2.3 Mallat Algorithm -- 4.2.4 Coefficient Characteristics of the R-Wavelet -- 4.2.5 Applications of the Discrete Wavelet Transform -- 4.3 Dyadic Wavelet Transform and Singularity Detection of the Signal -- 4.3.1 Dyadic Wavelet and Dyadic Wavelet Transform -- 4.3.2 B-Sample-Based Dyadic Wavelet Function with a Scale Function -- 4.3.3 Decomposition and Reconstruction Algorithm for Dyadic Wavelet Transform -- 4.3.4 Wavelet Transform Modal Maxima Representation of Signals and Singularity Detection Theory -- 4.3.5 Reconstructing the Original Signal Using Wavelet Transform Modal Maxima [51] --

4.3.6 Applications of the Dyadic Wavelet Transform [57] -- 4.4 Wavelet Representation of Fault Traveling Waves -- 4.4.1 Introduction -- 4.4.2 Fault Characteristics of Traveling Waves -- 4.4.3 Wavelet Transform Mode Maxima Representation of Various Traveling Waves -- 4.4.4 Comparison of Voltage Traveling Waves, Current Traveling Waves, and Directional Traveling Waves.

5 Fault Traveling Wave Transmission Characteristics of Transformers and Secondary Cables -- 5.1 Current Transformer Model and Its Dynamic Transfer Characteristics -- 5.1.1 Operating Principle of Current Transformers and Their Electromagnetic Transient Model -- 5.1.2 Operating Frequency Transfer Characteristics of Current Transformers -- 5.1.3 Transient Traveling Wave Transfer Characteristics of Current Transformers -- 5.2 Voltage Transformer Model and Its Dynamic Transfer Characteristics -- 5.2.1 Operating Principle of Voltage Transformers and Their Corresponding Electromagnetic Transient Models -- 5.2.2 Operating Frequency Transfer Characteristics of Capacitance-Divided Voltage Transformers -- 5.2.3 Transient Traveling Wave Transfer Characteristics of Capacitive Voltage Transformers Under a Simplified Model [69] -- 5.2.4 Transient Traveling Wave Transfer Characteristics of Capacitive Voltage Transformers Under a Detailed Model -- 5.3 Fault Traveling Wave Transmission Characteristics of Secondary Cables -- 5.3.1 Equivalence Analysis Between the Centralized and Distributed Parameter Models for the Secondary-Side Cable -- 5.3.2 Equivalent Modeling of Secondary-Side Cables -- 5.4 Traveling Wave Transmission Characteristics of the Secondary Current Transmission Channel -- 5.4.1 Joint Modeling of Secondary Current Loops [89] -- 5.4.2 Analysis of the Secondary-Side Circuit Transmission Characteristics [89] -- 6 Transmission Line Longitudinal Traveling Wave Direction Protection -- 6.1 Wave Impedance Relays -- 6.1.1 Basic Principles of Wave Impedance Relays -- 6.1.2 Algorithmic Study of Wave Impedance Relays -- 6.1.3 Performance Analysis of Wave Impedance Relays -- 6.1.4 Use of Wave Impedance Relays to Form Longitudinal Directional Protection -- 6.2 Uniform Traveling Wave Direction Relay -- 6.2.1 Fundamentals of the Unified Traveling Wave Direction Relay. -- 6.2.2 Uniform Traveling Wave Direction Relay Action Criterion -- 6.2.3 Modeling and Simulation -- 6.2.4 Motion Characteristics Analysis -- 6.2.5 Longitudinal Directional Protection of Transmission Lines Based on Unified Traveling Wave Directional Relays -- 6.3 Polarization Current Traveling Wave Direction Relay -- 6.3.1 Consistency of Line Wave Polarity for Voltage Faults at Different Frequency Bands -- 6.3.2 Polarization Current Traveling Wave Direction Relay Principle and Algorithm -- 6.3.3 Performance Analysis of Polarization Current Traveling Wave Direction Relay Operation -- 6.3.4 TP-01 Ultrahigh-Speed Traveling Wave Protection Device -- 7 Transmission Line Longitudinal Traveling Wave Differential Protection -- 7.1 Traveling Wave Differential Protection -- 7.1.1 Basic Principle of Traveling Wave Differential Protection -- 7.1.2 Traveling Wave Differential Current and Traveling Wave Braking Current Components [112] -- 7.1.3 Unbalanced Traveling Differential Current Analysis During Out-of-Area Disturbances or Faults -- 7.1.4 Comparison of Traveling Wave Differential Currents During in- and Out-of-Zone Faults -- 7.1.5 Action Criteria -- 7.1.6 Protection Algorithms -- 7.1.7 Modeling Simulation and Performance Evaluation -- 7.1.8 PT Disconnection Handling -- 7.1.9 TP-02 Traveling Wave Differential Protection Device -- 7.2 Reconfiguration of Current Traveling Wave Differential Protection -- 7.2.1 Reconstructing the Current Traveling Wave -- 7.2.2 Characterization of Reconstructed Current Traveling Waves -- 7.2.3

Principle of Reconfiguration of Current Traveling Wave Differential Protection -- 7.2.4 Reconfigured Current Traveling Wave Differential Protection Algorithm -- 7.2.5 Reconfiguration of Current Traveling Wave Differential Protection Performance Evaluation -- 7.3 Traveling Wave Differential Protection Based on Wavelet Transform Modulus Maxima.
7.3.1 Ideas for Constructing Traveling Wave Differential Protection Using Initial Traveling Wave Modulus Maxima.
