

Applications of Mathematics in Circuit Theory

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Abstract - Application of Gaussian in circuit theory, using Kirchhoff's 2nd law. In this paper for a given circuit, forming into matrices form by using Kirchhoff's 2nd law we solve and find the current values. Less than 3x3 matrices we can use Cramer's rule, but more than 3x3, Cramer's cannot be done, so gauss elimination method is used to find the current values for the given circuits

I. CIRCUITS

An electronic circuit is composed of individual electronic components like Transistors, Capacitors, Inductors and Diodes, Resistors connected by conductive wires or traces through which Electric Current can flow. The combination of components and wires allows various simple and complex operations to be performed, signals can be amplified, computations can be performed, and data can be moved from one place to another. Circuits can be constructed of discrete components connected by individual pieces of wire

Let R = Resistance of the circuit

C = Capacitance in series with R

I = Current flowing

L = Inductor

V = voltage across R

R

V_c = voltage across C

V_L = voltage across L

L

II. OHM'S LAW

Ohm's law defines a linear relationship between the voltage and the current in an electrical circuit. The DC current flow through a resistor is set by the resistor's voltage drop and the resistor's resistance.

Ohm's Law Formula / Equation

When we know the voltage and resistance, we can calculate the current.

Ohm's law definition

The resistor's current I in amps (A) is equal to the resistor's voltage V_R = V in volts (V) divided by the resistance R in ohms

(Ω):



$$I = \frac{V}{R}$$

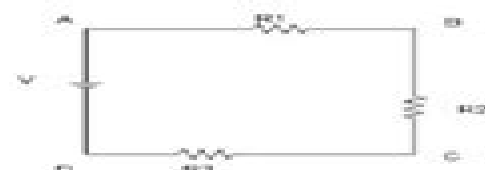
In 1845, a German physicist, Gustav Kirchhoff developed a pair or set of rules or laws which deal with the conservation of

current and energy within electrical circuits. Application of Gauss Elimination in circuits

III. KIRCHHOFF'S 2ND LAW

In a closed circuit the sum of the potential drops is equal to the sum of the potential rises.

In the closed loop ABCDA,



Branch	Potential drop	Potential rise
AB	IR_1	-
BC	IR_2	-
CD	IR_3	-
DA	-	V

Hence $IR_1 + IR_2 + IR_3 = V$

[Note: When we go from D to A (from the negative terminal to the positive terminal of the battery). There is a potential rise of V volts.

I_3

Assume the loop current to be I_1 , I_2 and I_3 as shown in the figure, all clockwise.

The currents through R_A , R_C , R_E are I_1 , I_2 , I_3 respectively.

The current through R_B is $I_1 - I_2$ & through R_D is $I_2 - I_3$.

Branch	Potential rise	Potential drop
PQ	$I_1 R_A$	-
QV	$(I_1 - I_2) R_B$	-
VW	-	V
WP	-	V

Mathematics For Electrical Circuit Analy

Satish K Karna



Mathematics For Electrical Circuit Analy:

The Mathematics of Circuit Analysis Ernst A. Guillemin, 1965 Mathematics for Electrical Circuit Analysis David Philip Howson, 1966 Transients for Electrical Engineers Paul J. Nahin, 2018-07-05 This book offers a concise introduction to the analysis of electrical transients aimed at students who have completed introductory circuits and freshman calculus courses While it is written under the assumption that these students are encountering transient electrical circuits for the first time the mathematical and physical theory is not watered down That is the analysis of both lumped and continuous transmission line parameter circuits is performed with the use of differential equations both ordinary and partial in the time domain and the Laplace transform The transform is fully developed in the book for readers who are not assumed to have seen it before The use of singular time functions unit step and impulse is addressed and illustrated through detailed examples The appearance of paradoxical circuit situations often ignored in many textbooks because they are perhaps considered difficult to explain is fully embraced as an opportunity to challenge students In addition historical commentary is included throughout the book to combat the misconception that the material in engineering textbooks was found engraved on Biblical stones rather than painstakingly discovered by people of genius who often went down many wrong paths before finding the right one MATLAB is used throughout the book with simple codes to quickly and easily generate transient response curves

The mathematics of circuit analysis Ernst A. Guillemin, 1959 *The Mathematics of Circuit Analysis* Ernst S. Guillemin, 2003-03-17 A text book designed to give the engineer a reasonably complete coverage of the mathematical topics needed specifically or collaterally in the analysis or synthesis of electrical networks Interval Methods for Circuit Analysis L. V. Kolev, 1993 Written by an electrical engineer this book presents a novel approach in electric circuit theory which is based on interval analysis an intensively developing branch or applied mathematics Covering major topics in both circuit and system theory and their applications it suggests a variety of methods that are suited for handling linear and nonlinear analysis problems in which some or all of the relevant data are given as intervals Detailed algorithms of the interval methods presented are developed enabling their easy implementation on computers For the convenience of the reader a comprehensive survey of all the necessary interval analysis notions and techniques is provided in the introductory text Most of the theoretical developments considered in the book are also clearly illustrated through numerical examples Interval Methods For Circuit Analysis L Kolev, 1993-09-23 Written by an electrical engineer this book presents a novel approach in electric circuit theory which is based on interval analysis an intensively developing branch or applied mathematics Covering major topics in both circuit and system theory and their applications it suggests a variety of methods that are suited for handling linear and nonlinear analysis problems in which some or all of the relevant data are given as intervals Detailed algorithms of the interval methods presented are developed enabling their easy implementation on computers For the convenience of the reader a comprehensive survey of all the necessary interval analysis notions and techniques is provided in

the introductory text Most of the theoretical developments considered in the book are also clearly illustrated through numerical examples

Electric Circuit Analysis Charles J. Monier, 2001 This book establishes a clear relationship between the basic principles of electric circuit analysis and the problem solving procedures for analyzing electric currents It contains traditional topics in electric circuit analysis along with matrix methods for solving systems of algebraic equations for simultaneous solutions derivatives and integrals differential equations and Laplace transformers Chapter titles Ohm's Law and Resistance Kirchhoff's Laws and Resistor Combinations Basic Analysis Tools Numerical Methods Multi Loop Circuits Network Theorems The Operational Amplifier and Basic Measuring Devices Capacitors Inductors Mathematics for ac Circuits Network Theorems Applied to ac Circuits Two Port Networks and Three Phase Circuits A reference for professionals in technology related industries

The Mathematics of Circuit Analysis, 1950

Electric Circuit Analysis Steven G. Conahan, 1996

Electric Circuits Demetrios P. Kanoussis, 2015-04-06 Electric Circuits constitute a core course in every Electrical Engineering curriculum with applications covering a wide area of disciplines like Electronics Electrical Machines Frequency Domain Analysis Transmission Lines etc In this book we lay out the foundations introducing fundamental principles definitions and formulas which are necessary for the understanding of more advanced topics The material is presented in a clear understandable format while the characteristic examples and problems accompanied by their solution contribute immensely to a thorough comprehension of the related material

Engineering Mathematics Dr. Raju Dindigala, Chandu G, Dr. Bhooma S, Mrs. Ramya S, 2025-01-17 Engineering Mathematics that fundamental and advanced mathematical concepts essential for engineering students It provides a structured approach to topics such as calculus linear algebra differential equations complex numbers numerical methods and probability With a focus on problem solving and real world applications the integrates theoretical explanations with practical examples to enhance understanding Designed to meet the academic requirements of engineering courses it serves as a valuable resource for students and professionals seeking to strengthen their mathematical foundation and analytical skills in various engineering disciplines

Applied Mathematics in Ferroelectricity and Piezoelectricity Kenji Uchino, 2023-12-29 This textbook Applied Mathematics in Ferroelectricity and Piezoelectricity was authored to provide the reader solid mathematical background for studying ferroelectricity and piezoelectricity as a supplemental reference to my three course books Ferroelectric Devices 2nd Edition 2010 Micromechatronics 2nd Edition 2019 and FEM and Micromechatronics with ATILA Software 2008 all published from CRC Press Physics prefers simplicity converting a complicated phenomenon expressed by a function

Electric Circuit Theory R. Yorke, 2013-10-22 Electric Circuit Theory provides a concise coverage of the framework of electrical engineering Comprised of six chapters this book emphasizes the physical process of electrical engineering rather than abstract mathematics Chapter 1 deals with circuit parameters while Chapter 2 covers the natural and forced response of simple circuit Chapter 3 talks about the sinusoidal steady state and Chapter 4 discusses the circuit analysis The fifth chapter

tackles frequency response of networks and the last chapter covers polyphase systems This book will be of great help to electrical electronics and control engineering students or any other individuals who require a substantial understanding of the physical aspects of electrical engineering **Mathematical for Electrical Circuit Analysis** David Philip Howson,1966

Special Functions and Analysis of Differential Equations Praveen Agarwal,Ravi P Agarwal,Michael Ruzhansky,2020-09-08 Differential Equations are very important tools in Mathematical Analysis They are widely found in mathematics itself and in its applications to statistics computing electrical circuit analysis dynamical systems economics biology and so on Recently there has been an increasing interest in and widely extended use of differential equations and systems of fractional order that is of arbitrary order as better models of phenomena in various physics engineering automatization biology and biomedicine chemistry earth science economics nature and so on Now new unified presentation and extensive development of special functions associated with fractional calculus are necessary tools being related to the theory of differentiation and integration of arbitrary order i e fractional calculus and to the fractional order or multi order differential and integral equations This book provides learners with the opportunity to develop an understanding of advancements of special functions and the skills needed to apply advanced mathematical techniques to solve complex differential equations and Partial Differential Equations PDEs Subject matters should be strongly related to special functions involving mathematical analysis and its numerous applications The main objective of this book is to highlight the importance of fundamental results and techniques of the theory of complex analysis for differential equations and PDEs and emphasizes articles devoted to the mathematical treatment of questions arising in physics chemistry biology and engineering particularly those that stress analytical aspects and novel problems and their solutions Specific topics include but are not limited to Partial differential equations Least squares on first order system Sequence and series in functional analysis Special functions related to fractional non integer order control systems and equations Various special functions related to generalized fractional calculus Operational method in fractional calculus Functional analysis and operator theory Mathematical physics Applications of numerical analysis and applied mathematics Computational mathematics Mathematical modeling This book provides the recent developments in special functions and differential equations and publishes high quality peer reviewed book chapters in the area of nonlinear analysis ordinary differential equations partial differential equations and related applications **A Collection of Problems on a Course of Mathematical Analysis** G. N. Berman,2016-06-06 A Collection of Problems on a Course of Mathematical Analysis is a collection of systematically selected problems and exercises with corresponding solutions in mathematical analysis A common instruction precedes a group of problems of the same type Problems with a physics content are preceded by the necessary physical laws In the case of more or less difficult problems hints are given in the answers This book is comprised of 15 chapters and begins with an overview of functions and methods of specifying them notation for and classification of functions elementary investigation of functions and trigonometric and

inverse trigonometric functions The following chapters deal with limits and tests for their existence differential calculus with emphasis on derivatives and differentials functions and curves definite and indefinite integrals and methods of evaluating definite integrals Some applications of the integral in geometry statics and physics are also considered along with functions of several variables multiple integrals and iterated integration line and surface integrals and differential equations The final chapter is devoted to trigonometric series This monograph is intended for students studying mathematical analysis within the framework of a technical college course

Circuit and Network Theory [GATE, PSUS AND ES Examination] Satish K Karna, Test Prep for Circuit and Network Theory GATE PSUS AND ES Examination **Applied Mathematics for**

Engineers and Physicists Louis A. Pipes, Lawrence R. Harvill, 2014-07-16 One of the most widely used reference books on applied mathematics for a generation distributed in multiple languages throughout the world this text is geared toward use with a one year advanced course in applied mathematics for engineering students The treatment assumes a solid background in the theory of complex variables and a familiarity with complex numbers but it includes a brief review Chapters are as self contained as possible offering instructors flexibility in designing their own courses The first eight chapters explore the analysis of lumped parameter systems Succeeding topics include distributed parameter systems and important areas of applied mathematics Each chapter features extensive references for further study as well as challenging problem sets Answers and hints to select problem sets are included in an Appendix This edition includes a new Preface by Dr Lawrence R Harvill Dover 2014 republication of the third edition originally published by McGraw Hill New York 1970 See every Dover book in print at www.doverpublications.com **Mathematics for Engineers and Technologists** Huw Fox, William Bolton, 2002-07-18 This book is carefully designed to be used on a wide range of introductory courses at first degree and HND level in the U K with content matched to a variety of first year degree modules from IEng and other BSc Engineering and Technology courses Lecturers will find the breadth of material covered gears the book towards a flexible style of use which can be tailored to their syllabus and used along side the other IIE Core Textbooks to bring first year students up to speed on the mathematics they require for their engineering degree Features real world examples case studies assignments and knowledge check questions throughout Introduces key mathematical methods in practical engineering contexts Bridges the gap between theory and practice

This book delves into Mathematics For Electrical Circuit Analy. Mathematics For Electrical Circuit Analy is a crucial topic that must be grasped by everyone, ranging from students and scholars to the general public. This book will furnish comprehensive and in-depth insights into Mathematics For Electrical Circuit Analy, encompassing both the fundamentals and more intricate discussions.

1. This book is structured into several chapters, namely:

- Chapter 1: Introduction to Mathematics For Electrical Circuit Analy
- Chapter 2: Essential Elements of Mathematics For Electrical Circuit Analy
- Chapter 3: Mathematics For Electrical Circuit Analy in Everyday Life
- Chapter 4: Mathematics For Electrical Circuit Analy in Specific Contexts
- Chapter 5: Conclusion

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4. In chapter 3, the author will examine the practical applications of Mathematics For Electrical Circuit Analy in daily life. The third chapter will showcase real-world examples of how Mathematics For Electrical Circuit Analy can be effectively utilized in everyday scenarios.
5. In chapter 4, this book will scrutinize the relevance of Mathematics For Electrical Circuit Analy in specific contexts. This chapter will explore how Mathematics For Electrical Circuit Analy is applied in specialized fields, such as education, business, and technology.
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The book is crafted in an easy-to-understand language and is complemented by engaging illustrations. This book is highly recommended for anyone seeking to gain a comprehensive understanding of Mathematics For Electrical Circuit Analy.

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