

## INTRODUCTION

In case of circuit having pure resistance only with direct current source, the current reaches its steady state value almost instantaneously. But when capacitor and inductor are part of the circuit, it takes some time. As capacitor is charged, it opposes the flow of current and similarly any change in current is opposed by the inductor.

## R - C CIRCUIT

### 2.1 CHARGING OF A CAPACITOR

The circuit diagram for charging and discharging a capacitor is given here. A resistor  $R$  and a capacitor  $C$  are connected with a double throw switch, by which the battery  $V$  can be connected in the circuit.

Initially, the capacitor is uncharged. When the switch is thrown to include the battery in the circuit, charge flows to the capacitor through the resistance  $R$ . This is called the charging current. The current continues till the voltage  $V_{ab}$  across the capacitor is equal to the voltage  $V$  of the battery. If during the charging process the instantaneous current is  $i$  at an instant as shown, and the potential difference between  $a$  and  $d$ , and that between  $d$  and  $b$  are  $V_{ad}$  and  $V_{db}$  respectively, then

$$V_{ad} = iR \text{ and } V_{db} = \frac{q}{C}$$

where  $q$  is the charge on the capacitor at that instant

$$V_{ab} = V = V_{ad} + V_{db} = iR + \frac{q}{C}$$

where  $V$  is the constant voltage of the battery.

$$i = \frac{V}{R} - \frac{q}{RC}$$

Initially, as soon as the connection is made there is a current  $i_0 = \frac{V}{R}$ , since the charge on the capacitance is zero

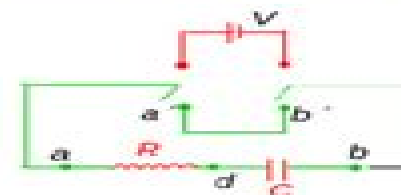
As the charging continues,  $q$  increases and  $i$  decreases and finally becomes zero. At that time,

$$\frac{V}{R} - \frac{q}{RC} = 0$$

$q = CV = Q_0$ , where  $Q_0$  is the final charge on the capacitor.

In equation (iii),  $i$  may be written as  $\frac{dq}{dt}$ , so

$$\frac{dq}{dt} = \frac{V}{R} - \frac{q}{RC}$$



... (i)

... (ii)

... (iii)



# Alternating Current Transient Circuit

**José Carlos Goulart de  
Siqueira, Benedito Donizeti Bonatto**



## **Alternating Current Transient Circuit:**

*Alternating-current and Transient Circuit Analysis* Harris A. Thompson, 1955      **Alternating Current and Transient Circuit Analysis** Harris A. Thompson, 2013-07      *Alternating-current and Transient Circuit Analysis* Harris A. Thompson (électricien), 1955      **High Voltage Circuit Breakers** Ruben D. Garzon, 2002-06-04 This newly revised and updated reference presents sensible approaches to the design selection and usage of high voltage circuit breakers highlighting compliance issues concerning new and aging equipment to the evolving standards set forth by the American National Standards Institute and the International Electrotechnical Commission This edition      *Alternating Current Multi-Circuit Electric Machines* Valentin Asanbayev, 2015-02-13 This book details an approach for realization of the field decomposition concept The book presents the methods as well as techniques and procedures for establishing electric machine circuit loops and determining their parameters The methods developed have been realized using the models of machines with laminated and solid rotor having classical structure The use of such models are well recognized and simplifies practical implementation of the obtained results      **Alternating-current and Transient Circuit Analysis. Answers to Problems** Harris A. Thompson, 1957      **Understanding Electromagnetic Transients in Power Systems** Luiz Cera Zanetta, Jr., 2025-03-26 Understand transients and their roles in linear systems with this essential guide Electromagnetic transients are a fundamental aspect of linear power systems and therefore a key knowledge area for electrical engineers Understanding Electromagnetic Transients in Power Systems provides a comprehensive but accessible overview to transients their underlying theory and mathematics and their impact in electrical power system design Its detailed but clear presentation makes it a must own for students and working engineers alike Readers of Understanding Electromagnetic Transients in Power Systems will also find Deep consideration of the relationship between foundational concepts mathematical calculations and impacts on equipment Detailed discussion of topics including time and frequency domain analysis basic transforms fundamentals of electrical circuit transients and traveling waves overvoltage insulation coordination and many more Dozens of solved simple examples to facilitate understanding Understanding Electromagnetic Transients in Power Systems is ideal for electrical engineers and professionals in utilities and equipment manufacturing as well as for graduate and advanced undergraduate students learning about transients electrical circuits and related subjects      **A Textbook of Electrical Technology Volume I: Basic Electrical Engineering** B L Theraja & A K Theraja, A Textbook of Electrical Technology Volume I Basic Electrical Engineering      **The General Theory of Alternating Current Machines** Bernard Adkins, Ronald G. Harley, 2013-11-11 The book on The General Theory of Electrical Machines by B Adkins which was published in 1957 has been well received as a manual containing the theories on which practical methods of calculating machine performance can be based and as a text book for advanced students Since 1957 many important developments have taken place in the practical application of electrical machine theory The most important single factor in the development has been the

increasing availability of the digital computer which was only beginning to be used in the solution of machine and power system problems in 1957 Since most of the recent development particularly that with which the authors have been concerned has related to a c machines the present book which is in other respects an up to date version of the earlier book deals primarily with a c machines The second chapter on the primitive machine does deal to some extent with the d c machine because the cross field d c generator serves as an introduction to the two axis theory and can be used to provide a simple explanation of some of the mathematical methods The equations also apply directly to a c commutator machines The use of the word general in the title has been criticized It was never intended to imply that the treatment was comprehensive in the sense that every possible type of machine and problem was dealt with Power System Transients Juan A.

Martinez-Velasco, 2017-12-19 Despite the powerful numerical techniques and graphical user interfaces available in present software tools for power system transients a lack of reliable tests and conversion procedures generally makes determination of parameters the most challenging part of creating a model Illustrates Parameter Determination for Real World Applications Geared toward both students and professionals with at least some basic knowledge of electromagnetic transient analysis Power System Transients Parameter Determination summarizes current procedures and techniques for the determination of transient parameters for six basic power components overhead line insulated cable transformer synchronous machine surge arrester and circuit breaker An expansion on papers published in the IEEE Transactions on Power Delivery this text helps those using transient simulation tools e g EMTP like tools to select the optimal determination method for their particular model and it addresses commonly encountered problems including Lack of information Testing setups and measurements that are not recognized in international standards Insufficient studies to validate models mainly those used in high frequency transients Current built in models that do not cover all requirements Illustrated with case studies this book provides modeling guidelines for the selection of adequate representations for main components It discusses how to collect the information needed to obtain model parameters and also reviews procedures for deriving them Appendices summarize updated techniques for identifying linear systems from frequency responses and review capabilities and limitations of simulation tools Emphasizing standards this book is a clear and concise presentation of key aspects in creating an adequate and reliable transient model *Current Interruption Transients Calculation* David F. Peelo, 2020-04-06 Provides an original detailed and practical description of current interruption transients origins and the circuits involved and shows how they can be calculated Based on a course that has been presented by the author worldwide this book teaches readers all about interruption transients calculation showing how they can be calculated using only a hand calculator and Excel It covers all the current interruption cases that occur on a power system and relates oscillatory circuit transients and symmetrical component theory to the practical calculation of current interruption transients as applied to circuit breaker application The book explains all cases first in theory and then illustrates them with practical examples Topics featured in Current

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**Transient Electric Phenomena and Oscillations - Third Edition** Charles Proteus Steinmetz, 2003-07     The Alternate Current Transformer in Theory and Practice: The induction of electric currents Sir John Ambrose Fleming, 1890

**Introduction to Transients in Electrical Circuits** José Carlos Goulart de Siqueira, Benedito Donizeti Bonatto, 2021-08-13 This book integrates analytical and digital solutions through Alternative Transients Program ATP software recognized for its use all over the world in academia and in the electric power industry utilizing a didactic approach appropriate for graduate students and industry professionals alike This book presents an approach to solving singular function differential equations representing the transient and steady state dynamics of a circuit in a structured manner and without the need for physical reasoning to set initial conditions to zero plus 0 It also provides for each problem presented the exact analytical solution as well as the corresponding digital solution through a computer program based on the Electromagnetics Transients Program EMTP Of interest to undergraduate and graduate students as well as industry practitioners this book fills the gap between classic works in the field of electrical circuits and more advanced works in the field of transients in electrical power systems facilitating a full understanding of digital and analytical modeling and solution of transients in basic circuits     Power Systems Leonard L. Grigsby, 2017-12-19 Power Systems Third Edition part of the five volume set The Electric Power Engineering Handbook covers all aspects of power system protection dynamics stability operation and control Under the editorial guidance of L L Grigsby a respected and accomplished authority in power engineering and section editors Andrew Hanson Pritindra Chowdhuri Gerry Shebl and Mark Nelms this carefully crafted reference includes substantial new and revised contributions from worldwide leaders in the field This content provides convenient access to overviews and detailed information on a diverse array of topics Concepts covered include Power system analysis and simulation Power system transients Power system planning reliability Power electronics Updates to nearly every chapter keep this book at the forefront of developments in modern power systems reflecting international standards practices and technologies New sections present developments in small signal stability and power system oscillations as well as power system stability controls and dynamic modeling of power systems With five new and 10 fully revised chapters the book supplies a high level of detail and more importantly a tutorial style of writing and use of photographs and graphics to help the reader understand the material New chapters cover Symmetrical Components for Power System Analysis Transient

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