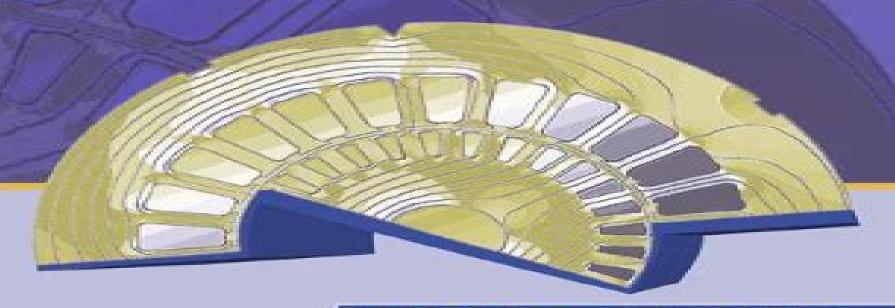
# ELECTRICAL MACHINE ANALYSIS USING FINITE ELEMENTS



**NICOLA BIANCHI** 



# **Finite Element Analysis Of Electrical Machines**

**CO Houle** 

#### **Finite Element Analysis Of Electrical Machines:**

Finite Element Analysis of Electrical Machines Sheppard Salon,2012-09-30 In Finite Element Analysis of Electrical Machines the author covers two dimensional analysis emphasizing the use of finite elements to perform the most common calculations required of machine designers and analysts The book explains what is inside a finite element program and how the finite element method can be used to determine the behavior of electrical machines The material is tutorial and includes several completely worked out examples The main illustrative examples are synchronous and induction machines The methods described have been used successfully in the design and analysis of most types of rotating and linear machines Audience A valuable reference source for academic researchers practitioners and designers of electrical machinery

**Finite Element Analysis Of Electrical Machines** Sheppard Joel Salon, 2006-10-01 **Electrical Machine Analysis** Using Finite Elements Nicola Bianchi, 2017-12-19 From the fan motor in your PC to precision control of aircraft electrical machines of all sizes varieties and levels of complexity permeate our world Some are very simple while others require exacting and application specific design Electrical Machine Analysis Using Finite Elements provides the tools necessary for the analysis and design of any type of electrical machine by integrating mathematical numerical techniques with analytical and design methodologies Building successively from simple to complex analyses this book leads you step by step through the procedures and illustrates their implementation with examples of both traditional and innovative machines Although the examples are of specific devices they demonstrate how the procedures apply to any type of electrical machine introducing a preliminary theory followed by various considerations for the unique circumstance The author presents the mathematical background underlying the analysis but emphasizes application of the techniques common strategies and obtained results He also supplies codes for simple algorithms and reveals analytical methodologies that universally apply to any software program With step by step coverage of the fundamentals and common procedures Electrical Machine Analysis Using Finite Elements offers a superior analytical framework that allows you to adapt to any electrical machine to any software platform and to any specific requirements that you may encounter **Finite Element Analysis of Electrical Machines** Sheppard J. Salon, 2012-12-06 In Finite Element Analysis of Electrical Machines the author covers two dimensional analysis emphasizing the use of finite elements to perform the most common calculations required of machine designers and analysts The book explains what is inside a finite element program and how the finite element method can be used to determine the behavior of electrical machines The material is tutorial and includes several completely worked out examples The main illustrative examples are synchronous and induction machines The methods described have been used successfully in the design and analysis of most types of rotating and linear machines Audience A valuable reference source for academic researchers practitioners and designers of electrical machinery Finite Elements for Electrical Engineers Peter Peet Silvester, Ronald L. Ferrari, 1996-09-05 Like the earlier editions this text begins by deriving finite elements for the simplest

familiar potential fields then advances to formulate finite elements for a wide range of applied electromagnetics problems A wide selection of demonstration programs allows the reader to follow the practical use of the methods Electrical Machines Valeria Hrabovcova, Pavol Rafajdus, Pavol Makyš, 2020-05-20 This book is devoted to students PhD students postgraduates of electrical engineering researchers and scientists dealing with the analysis design and optimization of electrical machine properties. The purpose is to present methods used for the analysis of transients and steady state conditions In three chapters the following methods are presented 1 a method in which the parameters resistances and inductances are calculated on the basis of geometrical dimensions and material properties made in the design process 2 a method of general theory of electrical machines in which the transients are investigated in two perpendicular axes and 3 FEM which is a mathematical method applied to electrical machines to investigate many of their properties of Two-dimensional Finite Element Analysis of Electrical Machines with Circuit Simulation Techniques Janne Väänänen, 1995 Electric Machines Ion Boldea, Lucian N. Tutelea, 2021-10-08 This Second Edition extensively covers advanced issues subjects in electric machines starting from principles to applications and case studies with ample graphical numerical results This textbook is intended for second and third semester courses covering topics such as modeling of transients control principles electromagnetic and thermal finite element analysis and optimal design dimensioning Notable recent knowledge with strong industrialization potential has been added to this edition such as Orthogonal models of multiphase a c machines Thermal Finite Element Analysis of FEA electric machines FEA based only optimal design of a PM motor case study Line start synchronizing premium efficiency PM induction machines Induction machines three and single phase synchronous machines with DC excitation with PM excitation and with magnetically salient rotor and a linear Pm oscillatory motor are all investigated in terms of transients electromagnetic FEM analysis and control principles Case studies numerical examples and lots of discussion of FEM results for PMSM and IM are included throughout the book The optimal design is treated in detail using Hooke Jeeves and GA algorithms with case comparison studies in dedicated chapters for IM and PMSM Numerous computer simulation programs in MATLAB and Simulink are available online that illustrate performance characteristics present in the chapters and the FEM and optimal design case studies and codes may be used as homework to facilitate a deeper understanding of fundamental issues **Combination of two-dimensional finite** element analysis of electrical machines with circuit simulation techniques Janne Väänänen,1995 The Finite **Element Method Applied to Rotating Electrical Machines** Per Berget, 1978 Electromagnetic Fields in Mechatronics, Electrical and Electronic Engineering Andrzej Krawczyk, Sławomir Wiak, Xose M. Lopez-Fernandez, 2006 More and more researchers engage into investigation of electromagnetic applications especially these connected with mechatronics information technologies medicine biology and material sciences It is readily seen when looking at the content of the book that computational techniques which were under development during the last three decades and are still being developed

serve as good tools for discovering new electromagnetic phenomena It means that the field of computational electromagnetics belongs to an application area rather than to a research area. This publication aims at joining theory and practice thus the majority of papers are deeply rooted in engineering problems being simultaneously of high theoretical level The editors hope to touch the heart of the matter in electromagnetism The book focuses on the following issues Computational Electromagnetics Electromagnetic Engineering Coupled Field and Special Applications Micro and Special Devices Bioelectromagnetics and Electromagnetic Hazard and Magnetic Material Modelling Abstracted in Inspec Element Analysis of Electrical Machines, Transformers and Electromagnetic Actuators Erich Schmidt, 2007 **Electrical** Machine Theory Through Finite Element Analysis A. Monti, F. Ponci, M. Riva, 2007 **Electrical Machine Fundamentals** with Numerical Simulation using MATLAB / SIMULINK Atif Iqbal, Shaikh Moinoddin, Bhimireddy Prathap Reddy, 2021-04-21 A comprehensive text combining all important concepts and topics of Electrical Machines and featuring exhaustive simulation models based on MATLAB Simulink Electrical Machine Fundamentals with Numerical Simulation using MATLAB Simulink provides readers with a basic understanding of all key concepts related to electrical machines including working principles equivalent circuit and analysis It elaborates the fundamentals and offers numerical problems for students to work through Uniquely this text includes simulation models of every type of machine described in the book enabling students to design and analyse machines on their own Unlike other books on the subject this book meets all the needs of students in electrical machine courses It balances analytical treatment physical explanation and hands on examples and models with a range of difficulty levels. The authors present complex ideas in simple easy to understand language allowing students in all engineering disciplines to build a solid foundation in the principles of electrical machines This book Includes clear elaboration of fundamental concepts in the area of electrical machines using simple language for optimal and enhanced learning Provides wide coverage of topics aligning with the electrical machines syllabi of most international universities Contains extensive numerical problems and offers MATLAB Simulink simulation models for the covered machine types Describes MATLAB Simulink modelling procedure and introduces the modelling environment to novices Covers magnetic circuits transformers rotating machines DC machines electric vehicle motors multiphase machine concept winding design and details finite element analysis and more Electrical Machine Fundamentals with Numerical Simulation using MATLAB Simulink is a well balanced textbook perfect for undergraduate students in all engineering majors Additionally its comprehensive treatment of electrical machines makes it suitable as a reference for researchers in the field

**Mathematical Models for the Design of Electrical Machines** Frédéric Dubas, Kamel Boughrara, 2021-03-15 This book is a comprehensive set of articles reflecting the latest advances and developments in mathematical modeling and the design of electrical machines for different applications. The main models discussed are based on the i Maxwell Fourier method in eight the formal resolution of Maxwell sequations by using the separation of variables method and the Fourier series

in 2 D or 3 D with a quasi Cartesian or polar coordinate system ii electrical thermal and magnetic equivalent circuit iii hybrid model In these different papers the numerical method and the experimental tests have been used as comparisons or validations Combination of Power Electronic Models with the Two-dimensional Finite Element Analysis of Industrial Electromagnetics Modelling J. Caldwell, R. Bradley, 2012-12-06 **Electrical Machines** Janne Väänänen, 1994 During the past few years the rapid development of computer tech nology has made high power computing facilities more readily accessible to a greater proportion of our industrial and academic community. This development coupled with the recent upsurge in mathematical modelling and computer simulation has led to significant developments in electromagnetic field theory and its applic ations to industry In view of such developments and the present high interest to both academics and industry the theme chosen for the Polymodel 6 Conference held at Newcastle upon Tyne in May 1983 was Industrial Electromagnetics Modelling To date the North East Polytechnics Mathematical Modelling and Computer Simulation Group has organised five successful Polymodel conferences each with a different theme The objectives of the Polymodel group include the promotion of collaborative research between Newcastle Sunderland and Teesside Polytechnics and industry in the areas of mathematical modelling and computer simulation The aim of the Polymodel 6 Conference was to call on and use the modelling and computer simulation expertise of eminent academics and industrialists who are deeply involved in the area of electro magnetics. These proceedings have a twofold purpose in that they contain current analytical and numerical techniques relevant to electromagnetic field problems and useful ideas on the modelling and simulation techniques which are most appropriate It was also felt important to include implications of computer developments both hardware and software on such work Electric Machines Dionysios Aliprantis, Oleg Wasynczuk, 2022-08-11 Demystifies the operation of electric machines by bridging electromagnetic fields electric circuits numerical analysis and computer programming Ideal for graduates and senior undergraduates taking courses on all aspects of electric machine design and control and accompanied by downloadable Python code and instructor solutions Electromagnetic Modeling by Finite Element Methods João Pedro A. Bastos, Nelson Sadowski, 2003-04-01 Unlike any other source in the field this valuable reference clearly examines key aspects of the finite element method FEM for electromagnetic analysis of low frequency electrical devices The authors examine phenomena such as nonlinearity mechanical force electrical circuit coupling vibration heat and movement for applications in the electrical mechanical nuclear aeronautics and transportation industries Electromagnetic Modeling by Finite Element Methods offers a wide range of examples including torque vibration and iron loss calculation coupling of the FEM with mechanical equations circuits converters and thermal effects material modeling and proven methods for hysteresis implementation into FEM codes Providing experimental results and comparisons from the authors personal research Electromagnetic Modeling by Finite Element Methods supplies techniques to implement FEM for solving Maxwell's equations analyze electrical and magnetic losses determine the behavior of electrical machines evaluate force distribution on a

magnetic medium simulate movement in electrical machines and electromagnetic devices fed by external circuits or static converters and analyze the vibrational behavior of electrical machines **Control Oriented Modelling of AC Electric** Machines Ahmed Masmoudi, 2018-04-11 The book discusses the modeling of induction and synchronous machines aimed at the synthesis of dedicated control strategies. The first part focuses on induction machines IMs and starts with the analysis of the principle of operation which is based on the induction phenomenon It then establishes the a b c model assuming a sinusoidal spatial repartition of the air gap flux density a linear magnetic circuit and constant phase resistors. The abc model enables the establishment of a state representation of the induction machine Then the Park transformation is introduced and applied to the IM a b c model leading to its Park one which is then used to analyze the IM steady state operation The chapter also includes a case study dealing with the doubly fed induction machine which is widely integrated in wind power generating systems Following the introduction of the continuous development of synchronous machines SMs the second part establishes the a b c model for salient pole machines Then the Park transformation is applied to the established a b c model leading to the Park one The section highlights the formulation and analysis of the electromagnetic torque with its synchronizing and reluctant components investigated in terms of the torque angle Subsequently it characterizes the operation at i maximum torque and ii unity power factor before focusing on the flux weakening approaches that could be implemented in SMs considering both smooth and salient pole topologies Lastly it presents a case study dealing with an investigation of the main features of the electric drive unit of a hybrid propulsion system and the possibility of their improvement with an emphasis on the extension of the flux weakening range

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