



## The Electrical Machines Problem Solver

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**Category :**Technology & Engineering / **Total Pages :** 786 pages

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generators generated emf armature windings no-load and load characteristics magnetizing ampere-turns losses and efficiency parallel operation of d c generators chapter 5 d c motors counter emf motor starting requirements speed and torque characteristics horse power losses and efficiency chapter 6 transformers primary and secondary voltages and currents power factor transformer constants and the equivalent circuit regulation losses and efficiency autotransformers and multicircuit transformers transformer design chapter 7 a c machines a c generator - wave-form and frequency of generated emf generated voltage and terminal voltage armature windings regulation and efficiency a c motor characteristics no-load and locked-rotor tests power torque and efficiency chapter 8 synchronous generators synchronous reactance and synchronous impedance zero-power-factor test and potier s triangle synchronous generator characteristics regulation and field current losses and efficiency parallel operation of synchronous generators chapter 9 synchronous motors synchronous motor characteristics torque torque angle hunting oscillation circle chart and v-curves power power factor and efficiency synchronous motor dynamics chapter 10 induction machines starting an induction motor determination of equivalent circuit parameters synchronous speed slip torque-slip curves pull-out torque and plugging power power factor torque and efficiency performance computations circle diagram sound intensity computation chapter 11 special machines permanent magnet generators reluctance motors repulsion motors reactors rectifiers converters synchronous condensers chapter 12 transmission and distribution of power transmission line reactance and capacitance transmission line calculations distribution circuits three wire system section ii ii-1 fundamentals of electricity ii-2 electrical machines dc generators dc motors ac generators ac motors ii-3 wire and motor data index what this book is for students have generally found electrical machines a difficult subject to understand and learn despite the publication of hundreds of textbooks in this field each one intended to provide an improvement over previous textbooks students of electrical machines continue to remain perplexed as a result of numerous subject areas that must be remembered and correlated when solving problems various interpretations of electrical machines terms also contribute to the difficulties of mastering the subject in a study of electrical machines rea found the following basic reasons underlying the inherent difficulties of electrical machines no systematic rules of analysis were ever developed to follow in a step-by-step manner to solve typically encountered problems this results from numerous different conditions and principles involved in a problem that leads to many possible different solution methods to prescribe a set of rules for each of the possible variations would involve an enormous number of additional steps making

this task more burdensome than solving the problem directly due to the expectation of much trial and error current textbooks normally explain a given principle in a few pages written by an electrical machines professional who has insight into the subject matter not shared by others these explanations are often written in an abstract manner that causes confusion as to the principle's use and application explanations then are often not sufficiently detailed or extensive enough to make the reader aware of the wide range of applications and different aspects of the principle being studied the numerous possible variations of principles and their applications are usually not discussed and it is left to the reader to discover this while doing exercises accordingly the average student is expected to rediscover that which has long been established and practiced but not always published or adequately explained the examples typically following the explanation of a topic are too few in number and too simple to enable the student to obtain a thorough grasp of the involved principles the explanations do not provide sufficient basis to solve problems that may be assigned for homework or given on examinations poorly solved examples such as these can be presented in abbreviated form which leaves out much explanatory material between steps and as a result requires the reader to figure out the missing information this leaves the reader with an impression that the problems and even the subject are hard to learn - completely the opposite of what an example is supposed to do poor examples are often worded in a confusing or obscure way they might not state the nature of the problem or they present a solution which appears to have no direct relation to the problem these problems usually offer an overly general discussion - never revealing how or what is to be solved many examples do not include accompanying diagrams or graphs denying the reader the exposure necessary for drawing good diagrams and graphs such practice only strengthens understanding by simplifying and organizing electrical machines processes students can learn the subject only by doing the exercises themselves and reviewing them in class obtaining experience in applying the principles with their different ramifications in doing the exercises by themselves students find that they are required to devote considerable more time to electrical machines than to other subjects because they are uncertain with regard to the selection and application of the theorems and principles involved it is also often necessary for students to discover those tricks not revealed in their texts or review books that make it possible to solve problems easily students must usually resort to methods of trial and error to discover these tricks therefore finding out that they may sometimes spend several hours to solve a single problem when reviewing the exercises in classrooms instructors usually request students to take turns in writing solutions on the boards and explaining them to the class students often find it difficult to

explain in a manner that holds the interest of the class and enables the remaining students to follow the material written on the boards the remaining students in the class are thus too occupied with copying the material off the boards to follow the professor's explanations this book is intended to aid students in electrical machines overcome the difficulties described by supplying detailed illustrations of the solution methods that are usually not apparent to students solution methods are illustrated by problems that have been selected from those most often assigned for class work and given on examinations the problems are arranged in order of complexity to enable students to learn and understand a particular topic by reviewing the problems in sequence the problems are illustrated with detailed step-by-step explanations to save the students large amounts of time that is often needed to fill in the gaps that are usually found between steps of illustrations in textbooks or review outline books the staff of Rea considers electrical machines a subject that is best learned by allowing students to view the methods of analysis and solution techniques this learning approach is similar to that practiced in various scientific laboratories particularly in the medical fields in using this book students may review and study the illustrated problems at their own pace students are not limited to the time such problems receive in the classroom when students want to look up a particular type of problem and solution they can readily locate it in the book by referring to the index that has been extensively prepared it is also possible to locate a particular type of problem by glancing at just the material within the boxed portions each problem is numbered and surrounded by a heavy black border for speedy identification

**Publisher :** Research Education Assoc on 1983 / **ISBN :** 0878915516

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