

# Practice of electrotechnical calculations conducting in the environment of MathCAD and Multisim

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**Abstract** — At this article we discuss the practice results of using the MathCAD and Multisim software products on a practical training course «The theory of electric and magnetic circuits and the Field theory». There are 3300 variants of problems on 33 themes in 11 course sections developed. Each topic is consisted of a control sample calculation in MathCAD environment and a calculation check of the virtual circuit model, implemented in the Multisim environment.

**Keywords** — *practical training; electric and magnetic circuits; Field theory; model; MathCAD; Multisim*

At the present stage of a human society development technical progress has high requirements to the process of training of specialists in technical colleges. The increasing role of the computer in science and technology should adequately correspond to its role as important auxiliary means in technical education. In this case, the contradiction between the information saturation of special disciplines and deficiency classroom time can be resolved by introduction to modern computer technology in the educational process.

On the basis of discussed problem methodology lies more than ten years author experience and results of using the different versions of the software: MathCAD, MATLAB application with Simulink, Multisim (Electronics Workbench ®), AutoCAD, Power Point and LabVIEW™ in teaching training engineers electro mechanics in Perm National Research Polytechnic University and electrical engineering majors in Perm Institute of Railway Transport. In this case, the information collected by the author during his visits to the technical universities of Germany, Austria, France and the USA [1-4] is also used.

At this research we discuss the practice results of using the software products MathCAD and Multisim on a practical training course «The theory of electric and magnetic circuits and the Field theory».

Applying of the spoken software allows different stages of learning process to organize the individual student's interactive work on the computer, where the most part of his or her time the student works independently. This may be the work on individual tasks, which are issued to students at home. Also it could be the group sessions, held in the computer lab under the supervision of the teacher with using specially designed electronic guides, which used MathCAD and Multisim (MathCAD - to perform

calculations, Multisim - for check the correctness of a virtual circuit model calculation) and implementing the principle of "do as I do."

A distinctive feature of the specified software products use in educational process is that they allow rather quickly, visually and elegantly to solve calculation, analytical, graphical tasks and modeling tasks without coding algorithms, i.e. in their natural view, and also to represent results of calculations in various forms. This makes it possible to concentrate basic attention of students in the performance of individual tasks for studied discipline, not on programming techniques.

Now 3300 variants of problems on 33 themes of following 11 sections of a course are developed:

- Linear circuits DC;
- Linear-phase circuits of sinusoidal current;
- Circuits with mutual induction;
- Linear two-port networks;
- Three-phase circuits;
- Linear circuits of non-sinusoidal current;
- Transients in linear circuits;
- Circuits with distributed parameters;
- Nonlinear circuits;
- Magnetic circuits;
- Field Theory.

At performance of individual tasks double-digit variant number corresponding to the last two digits of the record-book is set to the student. By the first (penultimate) digit student chooses a line in the table source data to the task, and by the second (last) - number of a variant of the scheme, i.e., there are 100 variants of solutions for each task provided. Each topic is consisted of a control sample calculation in MathCAD environment and a calculation check of the virtual circuit model, implemented in the Multisim environment. A presentation variety of the results allows the student to independently estimate the accuracy of the calculations and also to understand, learn physics modes of electric & magnetic circuits and problems in Field theory.


At the present time in Science and Technology Publishing House of St. Petersburg the collection of tasks

[5], Fig. is published in Russian, in which in the short form you may find the theory on each theme, tasks variants and methodical instructions of using MathCAD and Multisim for performance of electro technical calculations and the made virtual circuit model check-up results. The supplied collection of DVD-ROM includes all the test cases, which any student can, if desired, in the process of independent work to change and to adapt to the task of his variants. In addition the disc contains distributions of 30-day package versions MathCAD and Multisim and video tutorials online. According to the author, this book and DVD-ROM will be useful and in demand by students of universities electrical engineering specialties all forms of education, including students of the new forms of studying - distance online education, as well as teachers conducting course of TBE and course training.

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# Mathcad

ТЕОРИЯ И ПРАКТИКА ПРОВЕДЕНИЯ ЭЛЕКТРОТЕХНИЧЕСКИХ РАСЧЕТОВ

в среде  
**Mathcad и Multisim**

Данная книга ориентирована на применение программных продуктов Mathcad и Multisim (Electronics Workbench) для самостоятельного решения задач по основным разделам учебного курса «Теоретические основы электротехники». Сборник состоит из 11 глав, в которых в краткой форме приведены сведения из теории, даны методические указания по методам расчета и моделирования, и которые содержат 3300 вариантов задач по 33 темам, включая контрольные примеры по каждой теме. В контрольных примерах Mathcad используется для выполнения расчетов, Multisim – для проверки правильности расчета на составленной виртуальной модели цепи.

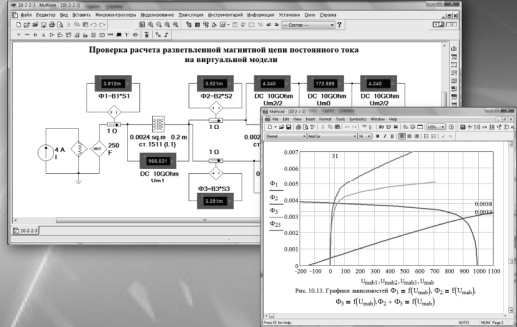
Сборник задач предназначен для студентов электротехнических специальностей технических вузов всех форм обучения, в том числе новой формы обучения – дистанционного интернет-образования, а также для преподавателей ведущих курс ТОЭ. Кроме того, отдельными главами сборника могут воспользоваться и студенты неэлектротехнических специальностей, которым читаются курсы «Основы электротехники» или «Электротехника с основами электроники», а также преподаватели, ведущие данные дисциплины и слушатели курсов повышения квалификации.

Mathcad ТЕОРИЯ И ПРАКТИКА ПРОВЕДЕНИЯ ЭЛЕКТРОТЕХНИЧЕСКИХ РАСЧЕТОВ

# Mathcad

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+ DVD с расчетными примерами, проектами, дистрибутивами Mathcad и Multisim, видеоуроками




Fig. Cover book copy