

Immediate processing of informational cards data ensures permanent actuality of rating picture created by the system. At the same time ratings data are saved regularly and may be viewed afterwards together with current one. As a reporting time interval for this a quarter and a year were accepted. Quarterly reports become accessible to view during the present year according to beginning of new quarter. At the end of the year the fourth quarter information is saved as a reporting for this year.

Results of quarterly and annual reports are announced in tables on the pages of public web-resource and may be ordered in different rating indexes and in groups of chairs and faculties (figs. 2 and 3). Exterior observer may trace the rating determination of any chair or faculty that considerably raises the trust to system data output (fig. 4).

Administrative part of the system allows to execute traditional operations to form and edit lists of faculties, chairs, inspecting departments, authorized users (administrators, inspectors, representatives of faculties and chairs) and so on. Invariance thesis is realized namely through the layer of administrators, so they can add, remove and edit records of rating indexes, parameters and coefficients changing the work of system with time as required.

Presented conception of computerized rating calculation system oriented to inner structural university units was realized for rating model accepted in Tomsk polytechnic university and tested on source data of informational cards collected on TPU chairs in 2002. At that there were given the results entirely coincident to official. Now the current version of the system is in test use in Tomsk polytechnic university to calculate inner ratings for 2003.

In conclusion we note, that system solutions we accepted allow to increase a number of rating objects types both to expand the objects scale (for example to calculate universities ratings) and backward (for example to calculate lecturers ratings).

A SERIES OF VIRTUAL LABORATORY EXERCISES FOR THE COURSE OF THEORETICAL FUNDAMENTALS OF ELECTROENGINEERING

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Abstract

In the article the series of ten virtual laboratory exercises described briefly. The set was developed at Tomsk Polytechnic University and intended for

students studying the course of theoretical fundamentals of electroengineering. Exercises correspond to all main parts of the course and supplemented by a laboratory guide which includes instructions for a user.

Keywords: transient processes, electromagnetic field, mutual capacitance, mutual inductivity, circuits with distributed parameters

At the Department of Theoretical Fundamentals of Electroengineering of Tomsk Polytechnic University the series of ten virtual laboratory exercises was developed recently. The exercises correspond to all main parts of the course of Electroengineering and can be used in the process of education. The laboratory guide was also developed and published which included brief theoretical description of physical phenomena under investigation and instructions for a user. We assume that a compact-disc with programs and the guide will be used by students for self-studies of the course.

The following laboratory exercises were developed:

1. Investigation into a circuit with distributed parameters.
2. Transient processes in a circuit with distributed parameters.
3. Investigation into electrostatic field of multiwire line.
4. Electric field of earthing.
5. Magnetic field of multiwire line.
6. Calculation of partial capacitances, potential and capacitances coefficients of an electric cable.
7. Detection of mutual induction of coils.
8. Transient processes in the simplest circuits.
9. Transient processes of the second order circuits.
10. Investigation into ferroresonance of voltages.

Each of the programs was developed in such a manner that to correspond with maximum accuracy to a real laboratory experiment. For example, in a real exercise dealing with detection of potential coefficients (Exercise No. 6) two out of three wires of the cable are earthed in turns. In a virtual experiment the earthing is also possible to realize. Performance of the program is illustrated in Fig. 1 where the interface of the application is shown. In the top left corner of the screen potentials and charges of the wires are printed. These data are sufficient to calculate potential coefficients and also to calculate mutual and intrinsic partial capacitances of wires.

In the next exercises the experiment is simulated in which mutual inductance of two coils is detected (Exercise No. 7). Interface of the application is shown in Fig. 2. The dialog of parameters setting is also shown here. The user has the possibility to change such parameters of the experiment as radii of

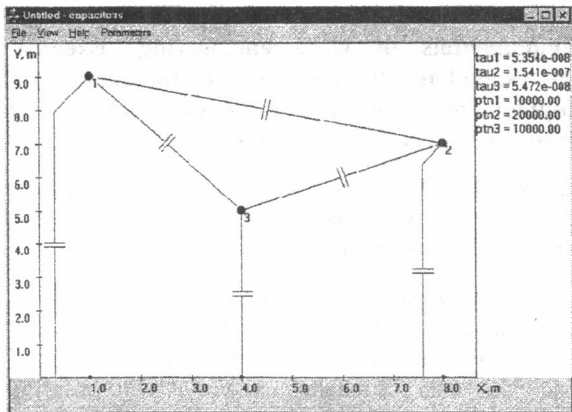


Fig. 1. Laboratory exercise "Mutual capacitance of wires". Interface of the application.

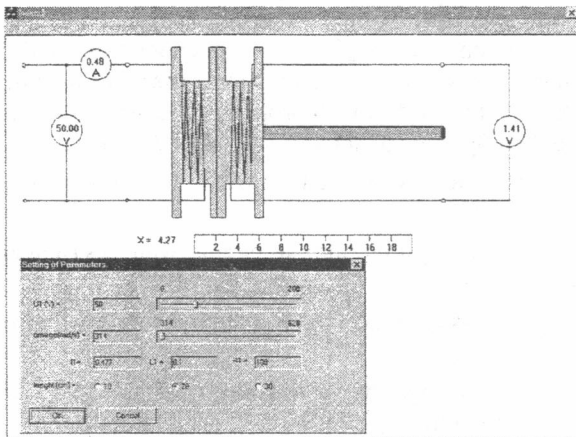


Fig. 2. Laboratory exercise "Mutual inductance of coils". Interface of the application.

coils and number of twists w , voltage U_1 applied to the first coil, and the maximum distance on which the displacement of the second coil is possible. Voltage U_1 allows one to determine current I_1 of the first coil. Voltage U_2 is registered in the experiment and according to the equation $M = U_2/wI_1$ mutual inductance M is calculated. The result of the exercises is the graph of dependence of mutual inductance on the distance between coils.

Laboratory exercise No. 9 was developed to help the student to study the part of the course in which the transient processes are considered. In the simulated experiment the changing of currents and voltages in the circuit of the second order is investigated. The circuit is connected to the source of direct voltage. Current in inductor and voltage of capacitor is represented in the screen as two functions dependent on time. Changes of the main elements of the circuit such as capacitance, inductance, and resistance are possible. So the three different kinds of transient processes are obtained, namely, oscillating, critical (or boundary), and aperiodical process. As an example, an aperiodical process is shown in Fig. 3.

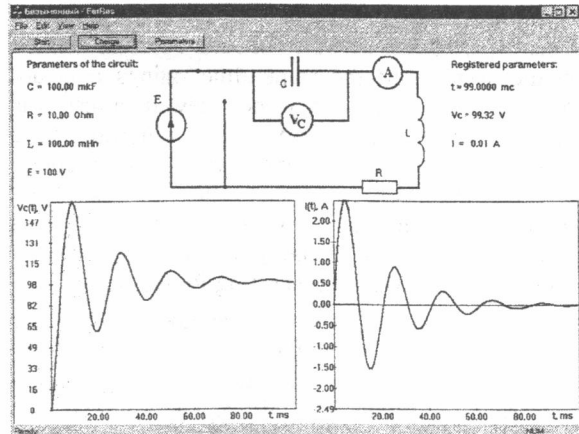


Fig. 3. Laboratory exercise "Transient process in a circuit of the second order". Interface of the application.

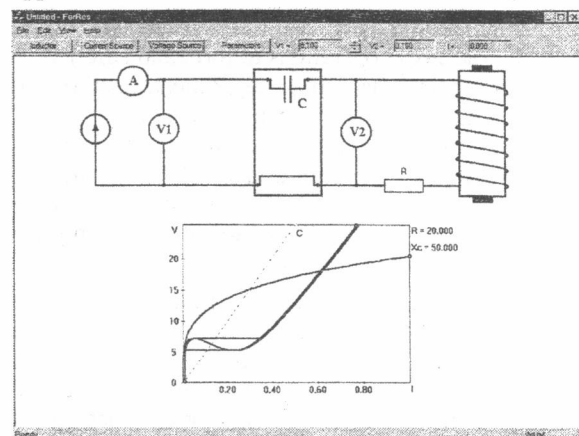


Fig. 4. Laboratory exercise "Investigation into ferroresonance". Interface of the application.

One more exercise included in the set is devoted to the topic *Nonlinear circuit*. In this application the phenomenon of ferroresonance of voltages is investigated. Interface of the application is shown in Fig. 4. At the beginning of the experiment the volt-ampere characteristic of the nonlinear inductor is registered. After that the linear capacitor is included in the circuit. The circuit is supplied from the source of current. The source of current allows one to obtain the characteristic of the circuit as a linear function of current. After changing the supply to the source of voltage the ampere meter shows the jump of current characteristic to the phenomenon of ferroresonance.

In conclusion we want to stress that all the programs are easy to operate, possess convenient interfaces and allow student to form the opinion about processes which develop in electric circuits.