

Design of resonant inverters using specialized software

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Abstract – In this paper presents an integrated software system, which automates the sequence for designing and analysis of resonant inverters. The system includes linking between specialized mathematical software (MathCAD) and electronic simulation software (Pspice).

Keywords – MathCAD, PSpice, CAD, Automation in electronics.

I. INTRODUCTION

The design of power electronic devices is related with significant expenses of time and materials. For optimization the design process different automated systems are created. One of the base tasks related to the development of the automated systems for computer aided design of power electronic devices is the creating of mathematical models for designing of electronic devices [4, 5, 6, 8]. These models present the objects with a corresponding approximation depending on the actual needs.

An important requirement when creating these models is the possibility that the developed automated systems to be easily serviced and to have minimum hardware requirements. On the other hand these automated systems must allow creating of the necessary documentation for realization of the corresponding devices.

II. AUTOMATION OF THE DESIGN

A. Object and sequence of the design

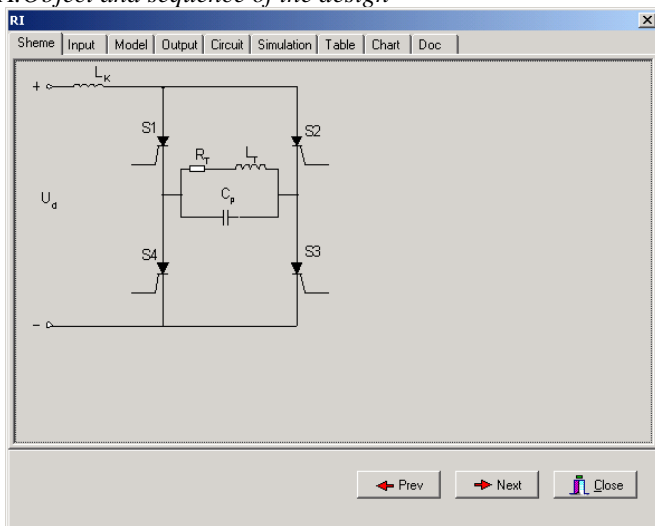


Fig. 1. Resonant inverters

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Fig. 1 shows the schematic of the device, which is the objective of the automated design.

The sequence of designing of the resonant inverters has the following stages, which are realized in the presented software:

- Choice of the schematic
- Setting the input/output parameters of the device
- Choice of the components according to the mathematical model
- Visualization the values of the circuit components
- Creating the simulation model
- Simulating the electronic circuit
- Obtaining the results as graphics
- Analysis of the simulation results
- Creating the project documentation

B. Software architecture

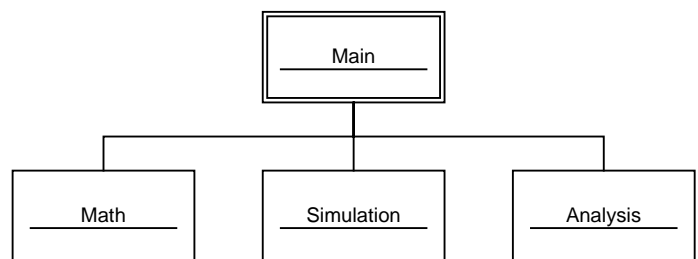


Fig. 2. Software architecture

Using the program environment Delphi develops the presented software system. The possibilities for component programming with linkage between the different software products under Windows are used. The system is built on several units, which are shown at fig. 2. The base unit (**Main**) integrates the rest of the units in the system. The unit **Math** realizes the mathematical model of the resonant inverter, obtained by the environment of the math MathCAD [11]. The unit has as an input the base input/output parameters of the circuit, and it outputs the values of the components of the resonant inverter circuit. The exchanged data is presented, according to the object-oriented model. After the calculations, the results are converted in order to be suitable for simulation of the device. The next component of the system is the simulation unit, which is called **Simulation**. The **Simulation** unit is realized in the environment of the PSpice simulation software. The PSpice program is part of the designing system OrCAD. The standard data format, incoming into the unit is the "CIR" file, and the standard output is "DAT" file, which contains values of the currents and the voltages of the examined circuit [12].

C. Mathematical model

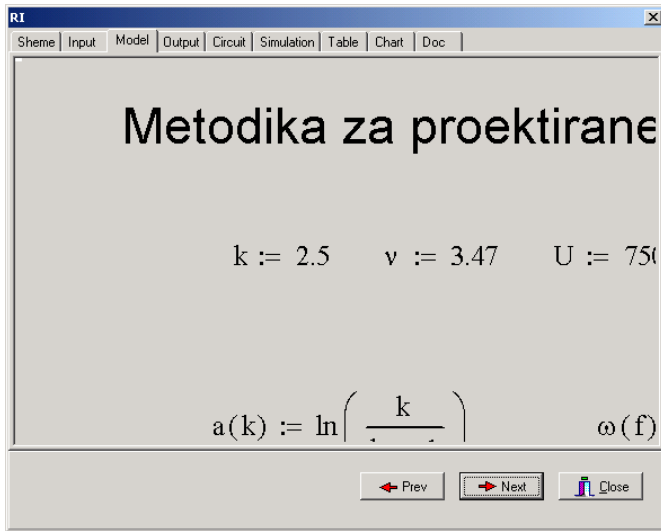


Fig. 3. Mathematical model

Fig. 3 shows the mathematical model of the designed device. In the presented paper mathematical models realized in the MathCAD environment are used [6, 8]. Depending on the needs of the engineer and the type of the modeled device, it could be chose a mathematical model, which has the corresponding features [7, 2, 10, 3, 9].

D. Simulation model

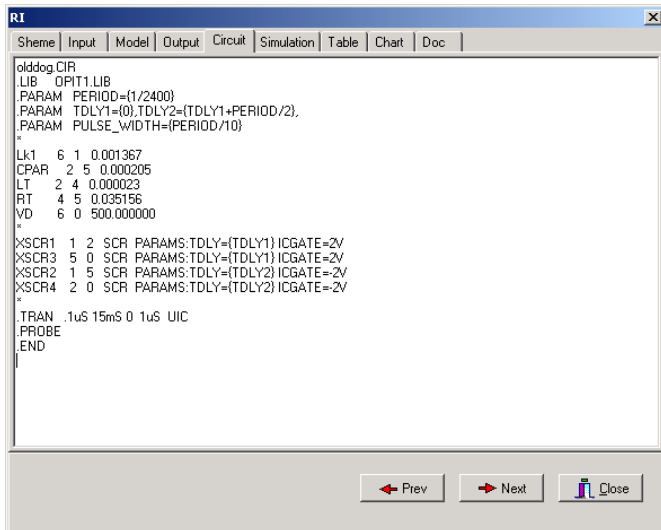


Fig. 4. Simulation (CIR) file

Fig. 4 presents the simulation model of the device. It is obtained, basing on the chosen circuit and the values of the components derived from the mathematical model.

E. Simulation

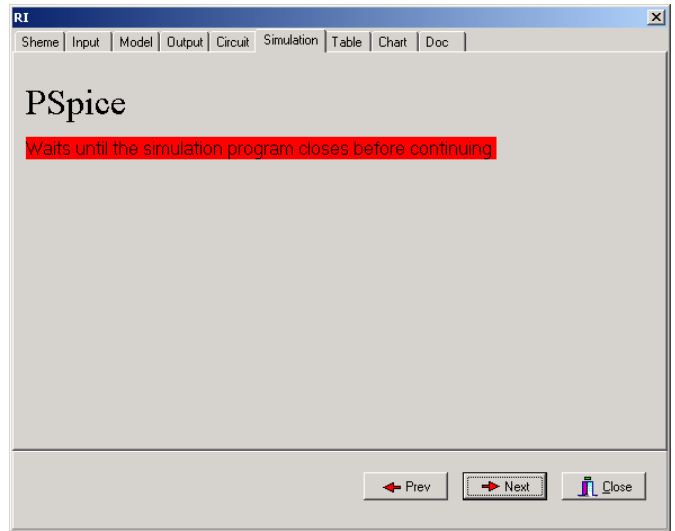


Fig. 5. Simulation process

Fig. 5 presents the user screen, which is shown through the simulation process and it shows to the user, that certain time is necessary to conclude.

F. Table result

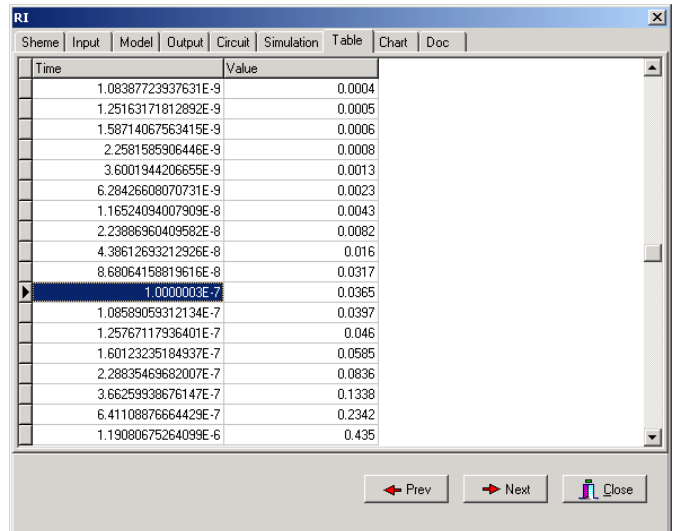


Fig. 6. Simulation result

Fig. 6 presents the simulation result in graphical way. In the first column is the time progress, and in the second there are the values of the input current.

III. EXAMPLE

G. Graphical result

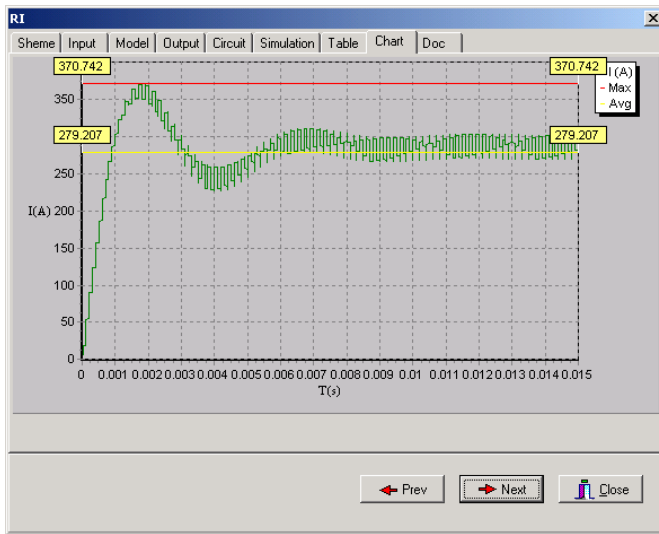


Fig. 7. Simulation result

Fig. 7 presents the simulation result for the moment values of the input current. The graph shows also the average and the maximum value of this current [8, 1].

H. Project documentation

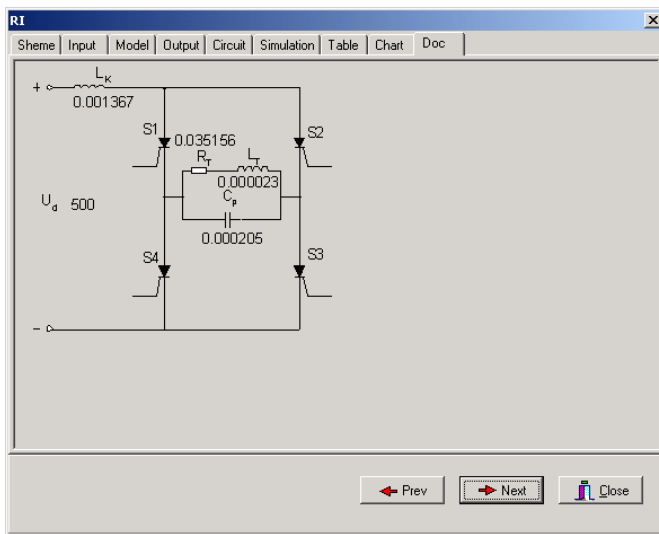


Fig. 8. Project documentation

Fig. 8 shows the last stage of the designing sequence – creating the project documentation.

I. Input Data

Fig. 9. Input data

Fig. 9 presents user dialog for the input data, which is necessary for the design.

J. Output data

Name	Value
ω_0	4336.273968
I_d	320.000000
R_{TK}	3.515625
R_T	0.035156
L_T	0.000023
R_1	1.927657
X_1	1.749588
δ	705.081816
L_K	0.001367

Fig. 10. Output data

Fig. 10 presents the result from the mathematical modeling, showing the values of the components of the chosen circuit and some other parameters of the designed device.

IV. CONCLUSION

In the presented automated system are embedded the phases for designing the power electronic devices, which are related to: choice of power circuit, electrical design, computer simulations of the operation of the examined circuit, comparison between the results of the simulation and the design and creating the project documentation.

The developed system allows designing of autonomous inverters at various input data and choice of optimum decision depending on the particular requirements. It also allows the learners to control the results after performing the tasks of designing the different types power electronic devices, which are applicable at the electrotechnologies.

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