Available online at www.sciencedirect.com

SciVerse ScienceDirect

IERI Procedia 2 (2012) 450 – 454

Procedia IERI

www.elsevier.com/locate/procedia

2012 International Conference on Future Computer Supported Education

The Study of Electronic Design Public Elective Courses Teaching in Colleges and Universities by Tina Pro

Yang Sha

Zunyi Normal College , School of Physics and Mechanical & Electrical Engineering, Zunyi 563002

Abstract

With the continuous development of EDA technology, its advantage in electronic courses teaching in college and universities is becoming increasingly prominent. The introduction of Tina Pro technology into the teaching of Electronic Design public elective courses in colleges and universities can improve the non electronic students' interesting in learning Electronic Design, let the Electronic Design get a more effective and wider promotion, and improve the students' innovation ability and manipulative ability.

Key words: Electronic Design, Teaching, Public Elective Courses

1. Introduction

EDA (Electronic Design Automation)refers to the electronic CAD generalized software package that is constructed on the computer platform and developed by the integration of the latest developments of applied electronic technology, computer technology and intelligent technology. With EDA, electronic engineers can start from the concept, algorithms, protocols to guide the computer in circuit design, performance analysis, finally the whole process of Electronic Design of IC layout or PCB layout[1]. As the basic mean of circuit and system design in the 21st century, EAD technology is continuing to mature. Introducing the EAD technology into the teaching of electronic course in colleges and universities, adopting the EDA simulation technology to complete the demonstration experiments and validation experiments of circuit course lead to the intuitive and vivid experimental conclusion, which inspires the students' passion in learning and creating, at the same time, it also improve the students' innovation ability and enhance their confidence to participate in the "Electronic Design" Contest. For remote local colleges, the introduction of EAD can also be effective in reducing the

 doi:10.1016/j.ieri.2012.06.115

experimental investment, ease the pressures of experimental equipment shortage in local colleges and universities due to the increasing enrollment[2]. Introducing the EDA technology into non electronic public elective courses then make students learn Electronic Design in a vivid and intuitive platform, understand the familiar Electronic Design in life. The EDA technology can also solve students' problems in Electronic Design, improve their passion in learning and cultivate their innovation ability.

2. Simulation Technology and Software

The simulation is essentially a simulator research based on the similarity principle, which refers to the use of model to reappear the essential process in the actual system, and study the system through the model experiment. Modern simulation technology (system simulation technology) is based on a computer as a carrier of the model to achieve the simulation effect of physical model. The modern simulation technology is made up of three factors: system, model and computer, associated with modeling, model programming, simulation experiment and analysis, these elements have been integrated in one system as a major system of the EDA technology, its operation interface is visual, vivid and convenient, so it is easy to accept for non-electronic students[3].

There is so many EDA software of circuit simulation. In this paper, Tina Pro was taken as an example. Tina Pro is one of the important modern EDA software, it is mainly used in simulation and simulation analysis of a digital circuit. In the matter of simulating circuit analysis, in addition to simulation analysis functions such as DC analysis, instantaneous analysis, sinusoidal steady-state analysis, Fourier analysis, temperature sweep, parameter sweep, worst case and Monte Carlo statistics that owned by general simulation software, it can also carry out index design on output power and optimization calculation on the parameters of circuit elements. Moreover, it has a function of symbolic analysis, which means that is can provide the expression of time domain transient process or frequency domain transfer function; Tina Pro has the function of RF simulation analysis, abilities to draw the pole-zero diagram, pole diagram, phasor diagram, Nyquist diagram and others[4].

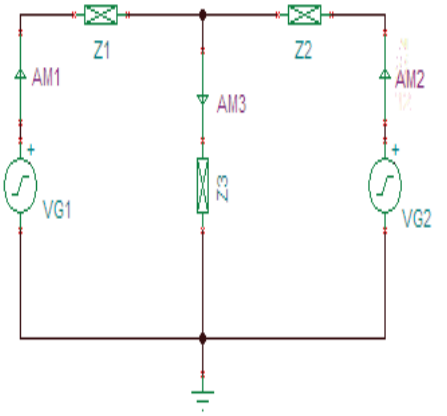
In the matter of digital circuit analysis, Tina Pro supports VHDL language, having the functions of BUS and virtual connection and so on. Tina Pro also has eight virtual measuring instruments, apparatus and components are connected by a virtual connection, the dynamic presentation function of virtual measuring instruments (such as multi- trace oscilloscope) is an excellent electronic teaching aid. Tina Pro can be connected to data acquisition instrument of real-time signal generator, therefore, it can compare real-time measurement with virtual simulation result, thus it is one of the few practical products to achieve this function. In addition, Tina Pro is also one of the few mature software with simplified Chinese interface[4]. It can play the role of high- efficiency, high precision in the development and manufacture of electronic products in engineering practice, moreover, its introduction into the teaching of non electronic public elective courses in colleges also has some unexpected teaching effect.

3. Simulation Examples

Tina Pro is a fairly perfect virtual working platform, it contains approximately more than 20,000 discrete or integrated circuit components. Now, the Tina Pro working platform was adopted to conduct simulation example analysis on non electronic public elective courses.

When the input signal in a circuit is sinusoidal, and the circuit has been in a stable working state, the sinusoidal steady-state analysis should be adopted. However, for non electronic students, they may figure out how it works when the input signal is direct current in basic series-parallel circuit, the sinusoidal-steady state analysis seems more difficult for them, next Tina Pro was used to carry out sinusoidal steady-state analysis. In order to have a more full explanation, the series-parallel of impedance was taken as an example.

Fig.1 Shows the series-parallel circuit of impedance, the principle of this circuit is known as following: At any instant, the current's algebraic sum at any node is identically equal to zero; at any instant, along any loop circulation direction, the voltage's algebraic sum in loop is identically equal to zero.



3.1. Theoretical Analysis

The circuit in Fig.1 shows, $Z_1 = 0.1 + j0.5\Omega$, $Z_2 = 0.1 + j0.5\Omega$, $Z_3 = 5 + j5\Omega$, VG1(U_1)=230/0V, VG2(U_2)=227/0V, the theoretical calculation value of AM3 is:

AM1=18.2/-51.1° A,AM2=13.3/-39.3° A,AM3=31.3/-46.1° A;

U_{Z_1}=9.3/27.6° V, U_{Z_2}=6.8/-140.6° V, U_{Z_3}=221.8/178.9° V.

Students of non electronic major can not understand the above knowledge, they just learn it by reciting, so it is completely unfamiliar for them.

3.2. The Establishment and Analysis of Simulation Circuit

(1) Circuit Establishment: The experimental circuit diagram analyzed with the use of TINA is shown in Fig.1. In the design interface of TINA, clicked on the required components from the component bar Basic, Meters, then connected the circuit according to the circuit diagram, be sure to select the reference point. Then completed the parameter setting of VG1、VG2、Z_1、Z_2、Z_3 according to the known conditions;

(2) Simulation: After the completion of parameter setting, moved on to the sinusoidal steady- state analysis of the circuit.

① Calculated the current and voltage in the circuit. Clicked on the "analysis" in menu bar, chose "AC analysis / calculate nodal voltages", then the circuit will show that AM1 is 18.2 A and its phase is-51.1°, AM2 is 13.3A and its phase is-39.3°, AM3 is 31.4A and its phase is-46.1°, meanwhile a cursor looks like a probe will pop up, moved the cursor to the tested component "Z_1" and clicked the left mouse button , the current direction passed "Z_1"will be demonstrated in the circuit and a dialogue box will pop up, the dialog box will demonstrate the value of "U_{Z_1}": the AC voltage is 9.3V , and its phase is27.6°, as shown in Fig.2. Similarly, the value of "U_{Z_2}"shows the AC voltage is 6.78V, and its phase is-140.6°, and the value of

"U_{Z_3} "shows the AC voltage is 221.8V , and its phase is178.9° , all of them are consistent with the theoretical values.

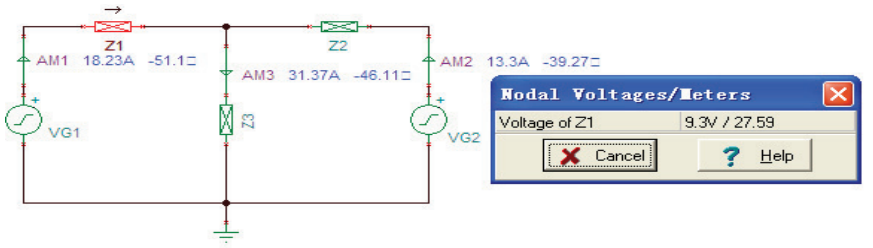


Fig.2 Simulation Results

② Table of AC results. Clicked on the "analysis" in menu bar, chose "AC analysis / Table of AC results", each node in the circuit will be demonstrated by squares, meanwhile the dialogue box will pop up, all nodes and AC voltages and phases between nodes will be demonstrated in the dialog box, the cursor will also change into a probe –type, clicked on "Z_1 ", the" V- Z_1 [5,4] = 9.3V/27.59 " bar in the dialog box will turn red, it means that the AC voltage between node 5 and node 4 besides "Z_1 " is 9.3 V, and its phase is27.59° . As shown in Fig.3. Then conducted AC results analysis on other components in turn.

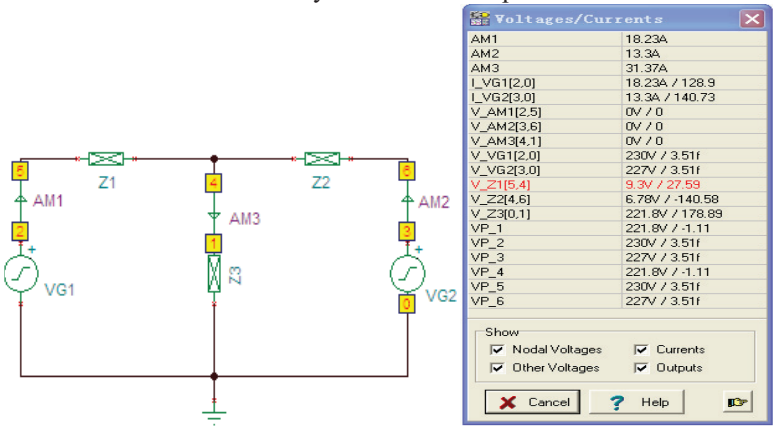
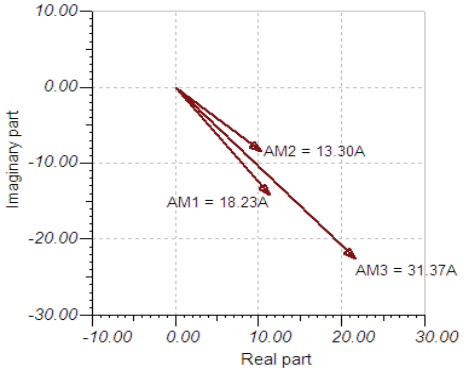
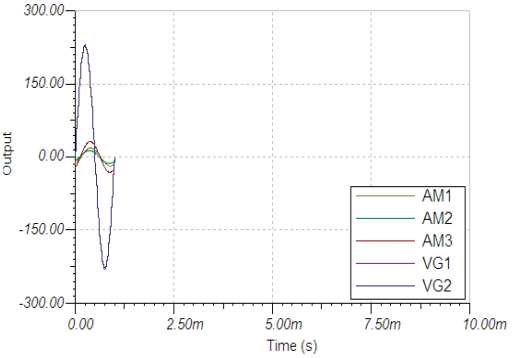


Fig.3 Table of AC Results

③ Phasor diagram. Clicked on the "analysis" in menu bar, chose "AC analysis / Phasor Diagram", the phasor diagram of input signal AM1, Am2, Am3 shown in Fig.4 will pop up.





④ Time function. Clicked on the "analysis" in menu bar, chose “AC analysis / time function”, the dialog box of parameter setting will pop up, set the parameters following the “Start time”、“End time”、“Number of points” “Draw excitation” in dialog box, after the parameters setting, pressed the "OK" button to draw a chart of time function, as shown in Fig.5 .

The using of Tina Pro can let the students of non electronic major have a more intuitive understanding of the sinusoidal steady-state analysis, the current direction and the relationship between time and output will visually appear in students’ mind. Furthermore, it can save much time for many Electronic Designs that carry out hardware circuit test after the simulation verification, thus improving the success rate of circuit design as well as students’ manipulative ability and innovation ability, moreover, the using of Tina Pro can make a better use of limited resources, let the non electronic students have a deeper understanding of electronic products around them everywhere .

4. Conclusion

EDA technology is a revolution in the field of Electronic Design, it is now in a stage of rapid development with rich resources and powerful functions. The application of EDA to the teaching of non electronic students solves many practical problems, students will have a more intuitive understanding of the abstract electronic courses through EDA platform and a new understanding of science learning, thus improving their interests, at the same time, the application of EDA also has a significant meaning in cultivating students’ abilities in innovation and manipulation.

5. Acknowledgment

Fund Items: The key supporting disciplines in Guizhou Province (issued by the department of higher education in Guizhou, [2011] No. 275)

References

[1] Gu Ping, Li Liangrong. Value of EDA [J]. Journal of Guizhou University; Natural Science, 2004,21 (1) :86- 89 .
[2] Yang Sha, Li Liangrong . The Study of Electronic Design Teaching in Local Colleges and Universities based on Tina Pro [J]. Journal of Zunyi Normal College, 2010 (4) :106- 108.
[3] Li Liangrong, Zhao Xiaolin. EDA and Electronic Design Teaching [J]. Journal of Guizhou University; Natural Science, 2002,11 (4) :360- 363 .
[4] Gu Liang. Guide to Circuit Simulation Software Tina Pro [M]. Beijing: Central Radio & TV University Press, 2003:2.