

Exploration of the Application of Electronic Circuit Simulation Technology in Integrated Circuit Design

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Abstract: In the current era of continuously improving technological level, various electronic products have emerged one after another, bringing great convenience to people's lives. Electronic circuit simulation technology is also widely used in circuit design, which has an important effect on improving the overall quality of circuit design. In addition, the widespread application of electronic circuit simulation technology has further reduced the development time of similar products, ensuring circuit performance. Based on this, this article mainly explores and analyzes the application practice of electronic circuit simulation technology in integrated circuit design, for reference by relevant personnel.

Keywords: Electronic Circuit Simulation Technology; Overall Quality; Integrated Circuit; Application Practice

Introduction

With the continuous development of social economy, people are paying more and more attention to the development and research of electronic application technology, and electronic circuit simulation technology has emerged. It has been effectively applied in circuit design and has achieved new development. In order to fully utilize the application value of electronic circuit simulation technology in integrated circuit design, it is necessary to accurately locate and conduct in-depth analysis of electronic circuit simulation technology, explore the future development trend of electronic circuit simulation technology, and make its technology gradually mature and better applied and developed.

1. Application of Simulation Technology in Circuit Design Process

1.1 Circuit Scheme Design

Currently, electronic products are constantly innovating and developing, and people have higher requirements for integrated circuit performance in terms of circuit design. Therefore, only by continuously optimizing and innovating circuit design can the overall performance of the circuit be improved. The widespread application of electronic circuit simulation technology in circuit design allows for deeper analysis of circuit design and more complex integrated circuit performance, in order to better compress and process circuits, construct chip level circuits, thus enabling innovative development of electronic products, improving their quality, and providing them with higher performance levels.

In addition, the reasonable application of electronic circuit simulation technology can further design and develop the circuit performance and parameters of electronic products, further optimize and improve the circuit design scheme, and make the circuit performance more progressiveness and innovative. Moreover, when designing the circuit, we should also design the circuit based on the chip system concept to optimize the circuit performance, further standardize the circuit design to make it more professional and progressiveness.

1.2 Circuit Design Optimization

Electronic circuit simulation technology plays an important role in circuit optimization design, ensuring the quality of electronic products and circuit stability. So that we can achieve simulated analysis of the temperature environment of electronic products by using electronic circuit simulation technology to design circuits, and then optimize and improve the design plan based on circuit changes. In this way can the quality of electronic products be comprehensively improved and

the circuit design also be gradually improved.

2. The Specific Application of Electronic Circuit Simulation Technology in Integrated Circuit Design

2.1 Introduction of PSPICE Simulation Software

The main function of the PSPICE simulation software is that the designer can detect various performance parameters of the circuit by observing the simulation processing results.

Generally speaking, when designing large-scale integrated circuits, we mostly use Cadence's PSPICE simulation software. In order to better develop integrated circuits, this software can be used to mix analog and digital simulation circuits, and in the process of multiple times of detection and correction, it can ensure that the performance indicators of the circuit are consistent with the design goals. The important function of PSPICE software is to simulate circuits or text files, and designers can carefully observe the simulation results to detect various circuit performance parameters^[1].

2.2 Specific Functions of PSPICE Simulation Software

PSPICE simulation software has two main functions, one of which is the basic analysis module, namely PSPICE AD, including DC analysis, AC analysis, and timely domain analysis. The second is the advanced analysis module, namely PSPICE AA, including parameter scanning, temperature analysis, and worst-case analysis.

The simulation technology has the following forms:

① Noise analysis simulation technology mainly calculates data based on the circuit at a set frequency, specifies that there is equivalent function at the output end. There is noise at the output, and the noise at the equivalent input of the specified input end is the electrical level.

② DC bias point simulation technology mainly refers to the phenomenon that if the inductance in a circuit experiences a short circuit, it will open circuit with the capacitor. By calculating the static working point of the circuit, the circuit will open circuit. For small signal and transient analysis, before proceeding, letting the system automatically calculate the DC bias point and clarify the initial conditions for transient analysis, as well as the nonlinear model parameters under AC small signal conditions.

③ DC scanning analysis technology mainly refers to the analysis and calculation of the characteristics of DC output when a certain parameter of a circuit changes within a certain range.

④ Communication scanning analysis technology mainly calculates the linear frequency response characteristics of AC small signals, including amplitude frequency characteristics, phase frequency characteristics, and input or output impedance.

⑤ Parameter scanning analysis technology mainly analyzing the circuit characteristics of specified component parameters in a circuit according to their variation patterns.

The basic process of implementing simulation processing with the help of PSPICE software is shown in the **figure 1** below:

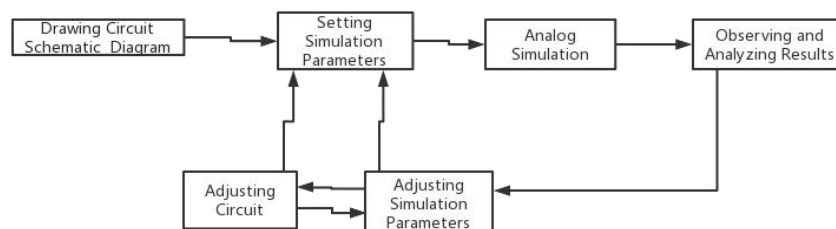


Figure 1 Basic Process of Simulation Processing

3. Application of Integrated Circuit Simulation Software

(1) Describing its simulation circuit to construct a simulation circuit diagram (**Figure 2**), focusing on the closing time of the control circuit.

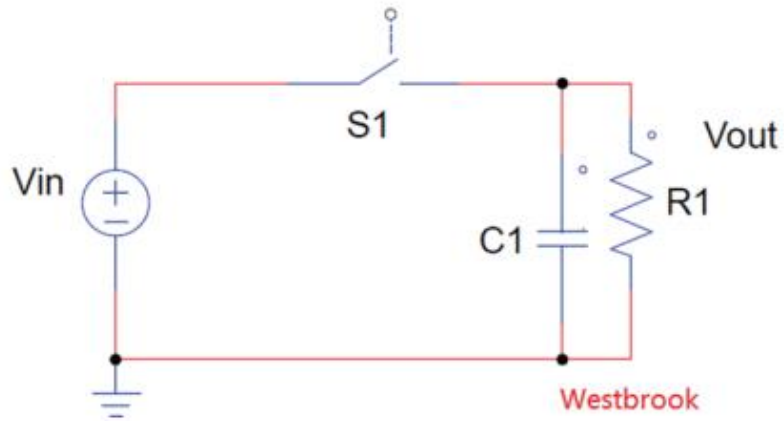


Figure 2 Simulation Circuit Diagram

(2) Simulation time and step size settings (Figure 3).

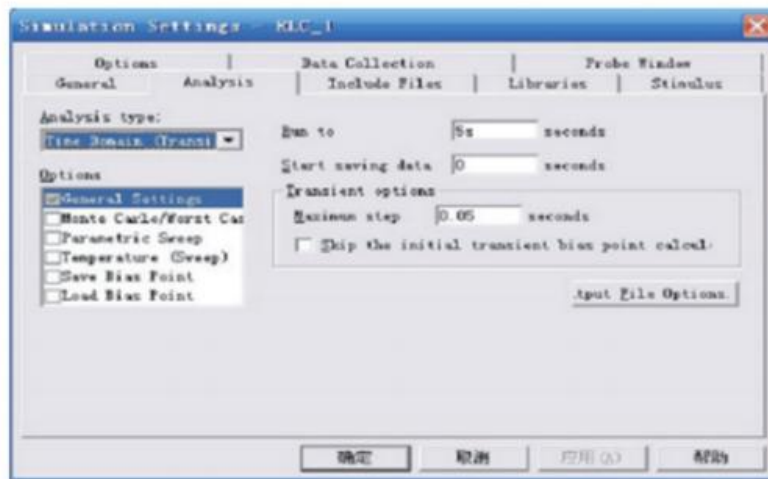


Figure 3 Simulation Time and Step Size Settings

(3) Running the simulation output waveform and simulation results (Figures 4-5).

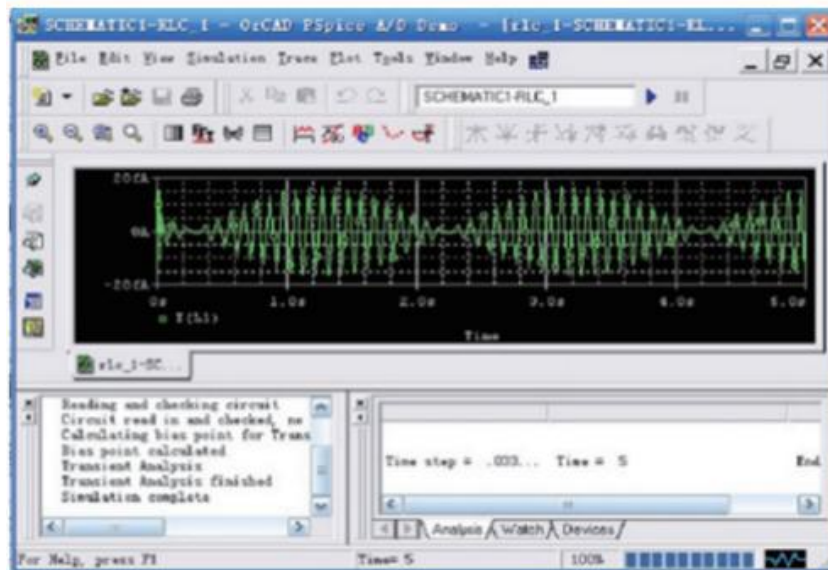


Figure 4 Output Waveform

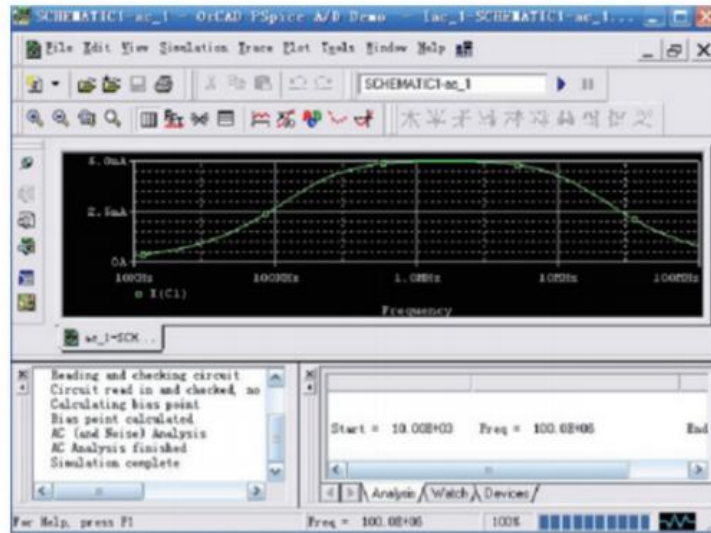


Figure 5 Simulation Results

3. The Development Trend of Electronic Circuit Simulation Technology

SPICE simulation software was developed by the University of California in the 1970s. With the continuous development of technology, the functions of circuit simulation software are gradually innovating and optimizing, and the technology is gradually maturing. Given its unique advantages, it has been widely used. In addition, PROTEL simulation software is also an important software, which has an important function of designing printed boards and circuit schematics, realizing the entire process application from circuit design to finished products, allowing electronic products to be fully realized and maximize their outstanding role. With the innovative development of computer technology, electronic circuit simulation technology is gradually being optimized and improved and becoming a complete processing system

For example, electronic circuit simulation technology is widely used in digital circuits of central processing units for simulation calculations. In the context of the rapid development of modern information technology, electronic application technology is also constantly innovating and optimizing. We conduct in-depth research on electronic circuit simulation technology, mainly focusing on hardware simulation research. When simulating the program function of the central processing unit, it can simulate the operation of the entire electronic system, achieve real-time simulation of the application program of the embedded electronic system, and also simulate its operation status to achieve real-time monitoring.

Electronic circuit simulation technology is also widely used in program operation, which is the direction of its technological innovation and development. As of now, due to certain limitations in both software and hardware design, how to simulate the central processing unit (CPU) is a key issue to be addressed. Correctly understanding process production can handle real-time issues such as application software design. Integrating electronic product system solutions into the semiconductor production process and effectively applying electronic circuit simulation technology can further make its production process more socialized and collaborative, and develop towards the direction of professional production. In addition, continuously optimizing its design methods, making development tools more concise, continuously optimizing and improving simulation technology, gradually shortening the development cycle of electronic products, and making electronic circuit simulation technology more innovative and advanced, which is also an important development direction for future research and development^[2].

Conclusion

To sum up, a large amount of practice has shown that electronic circuit simulation technology has important value for electronic applications. Applying it scientifically and reasonably, and gradually upgrading it, can significantly improve the quality of electronic products and the efficiency of electronic applications, which can provide a more convenient life for the public. Based on this, researchers in relevant fields in China actively explore and research electronic circuit simulation

technology, allowing it to receive continuous innovation and optimization, and entering a new stage of development for electronic applications, making new contributions to China's scientific and technological innovation.

References

[1] Wang MR. The Role of Electronic Circuit Simulation Technology in Electronic Application Development [J], *China Training*, 2022 (21): 11.

[2] Niu TL. Application of Simulation in Power Electronics Technology Teaching [J], *Laboratory Research and Exploration*, 2022, 34 (02): 84-87.

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