Application of Computer Artificial Intelligence in Circuit Logic Simulation

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Abstract. With the development of artificial intelligence technology, all walks of life have begun to add artificial intelligence into the development plan of enterprises. Among them, artificial intelligence chips are extremely important, it is the key to realize artificial intelligence technology. This article explains the concept and development of integrated circuits and logic simulation, and it analyses the basis and application of artificial intelligence technology in circuits.

1. Introduction
Artificial intelligence is the study of how to use computers to engage in thinking activities, such as reasoning, planning, design, thinking and learning, and how to solve complex problems, which require experts to handle. Computer expert system is the mainstream of current artificial intelligence research. This paper explores the application of artificial intelligence technology in circuits.

2. Integrated circuit
An integrated circuit is a tiny electronic device or component that can complete a certain function. It is roughly composed of three parts, including a series of elements such as transistors and resistors, a semiconductor chip or dielectric sheet that carries these elements, and a packaged shell. The advantages of integrated circuits include small size, light weight, long life, and low cost. These advantages determine that they can achieve large-scale processing and production. With the deepening development of integrated circuits, computers have changed from the original house size to now light and portable. With the further development of integrated circuits, their integration and performance will be further improved, which will become one of the core elements to promote the development of artificial intelligence[1].

The development of integrated circuits is based on the advancement of electronic technology.

(1) Electronic tube stage. The electron tube mainly uses the effect of the electric field on the electron flow in the vacuum to obtain the signal transmission and amplification function. However, due to the large size and high functional consumption of integrated circuits in specific operations, they are quickly eliminated after use. However, the emergence of electronic tubes has provided more support for subsequent circuit development.

(2) Transistor. Transistor is a kind of semiconductor device. It is a form of technology that can replace electronic tubes developed after the emergence of semiconductor materials. Compared with electronic tubes, transistors have more functions, such as rectifying, amplifying, stabilizing, and modulating signals[2].
(3) Integrated circuit. With the rapid development of modern electronic information technology, transistors are gradually being replaced by integrated circuits. In 1960, Fairchild Corporation of the United States produced the first monolithic integrated circuit that could be used. This move became an important symbol in the field of integrated circuits. After three eras, integrated circuits have developed more and more rapidly, especially the rapid development of my country's integrated circuit market. By 2015, my country's market scale has already accounted for 60% of the global market. The scale of development of domestic integrated circuits is shown in Figure 1.

![Figure 1. The scale of development of China's integrated circuits](image)

3. IC logic simulation

3.1. Principle of logic simulation
Logic simulation is a process of building a digital circuit model on a computer and making the model run. Here, "run" means to calculate the signal value of each response in the model circuit over time for a certain external input sequence excitation.

3.2. The main purpose of logic simulation
1) Evaluate the new design. The primary task of the logic designer is to check the correctness of the logic. On the basis of satisfying the logic function, obtain information about the circuit competition, risk and circuit oscillation conditions according to the time relationship, signal propagation characteristics or through simulation[3].

2) Analyse the failure. Analyse the monitorable faults with a given test sequence, including the operating characteristics of the circuit under specified fault conditions, and what fault resolution can be obtained for the given test sequence, etc.

3.3. Classification of logic simulation
Logic simulation can be divided into three levels: "gate" level; "function" level; "register" level. Gate-level simulation and function-level simulation are mainly used to check the correctness of logic design and failure analysis; register-level simulation is mainly used to check instruction operation schedule.

1) Gate-level simulation. The basic components of gate-level simulation include AND gates, OR gates, NOT gates, NAND gates, and NOR gates. Gate-level simulation also includes some basic register components such as flip-flops. It is the lowest-level logic element in digital circuits. The simulation.
Gate-level simulation is generally carried out after the logic design is basically completed. The main purpose is to check the correctness of the logic and timing[4].

2) Function level simulation. Function-level simulation allows some functional blocks as basic components of simulation, including adders, counters, codecs, etc. The main purpose of simulation is to check the correctness of logic. Function-level simulation requires that the logic circuits inside the functional components are detailed and accurate.

3) Register level simulation. Register-level simulation does not require detailed logic details, as long as the operation table is compiled or described in register transfer language, the simulation can be carried out. Register-level simulation mainly to check the flow of each instruction designed and its transmission in related registers. So Register-level simulation is mainly used to check the correctness of the instruction operation table.

4. The important development foundation of artificial intelligence technology
The application essence of intelligent technology is computer comprehensive application management technology based on integrated circuits. The core of the application of artificial intelligence technology is the algorithm, which realizes the training summary of the actual problem through the algorithm, and finally obtains the final solution to the problem by matching the actual problem[5]. With the in-depth development of science and technology, a series of algorithm research has become more complicated, and the implementation of the complexity of the algorithm essentially depends on the support of computer technology, especially the development support of integrated circuits. The rapid development of integrated circuit technology has promoted the speed of computer data processing and the application performance of computer systems. From a practical point of view, computer data will apply some more complex data algorithms when processing data information. These data algorithms are artificial intelligence algorithms. An important foundation for realization and effective application. From the perspective of practical application, the in-depth development of artificial intelligence technology needs the support of complex algorithms and data processing technology, and the in-depth development of integrated circuit technology can fully meet this demand. The application and improvement of integrated circuit technology determine the depth and level of development of artificial intelligence technology[6].

5. Application characteristics of artificial intelligence technology in integrated circuits
From the actual situation of the development of artificial intelligence, the basis of the development of artificial intelligence is computer technology. Under the development of computer technology, people put forward the concept of artificial intelligence. Therefore, the concept of artificial intelligence came into being in the 1950s. When it comes to artificial intelligence technology, the first thing people think of is the research and application of algorithms. Among them, the algorithm is in the software of the computer system, and the key to ensuring the stable application of the algorithm is the computer hardware system. This conclusion is based on artificial science. From the above series of analysis, it can be found that artificial intelligence algorithms belong to the level of computer software, and to realize the functions of the entire computer system still needs to rely on the basic performance of computer hardware[7]. With the progress of the times, people have asked whether it is possible to perform a series of algorithmic editing on the parts of digital integrated circuits on the basis of indirectly relying on the data processing functions of computer chips in the past, and finally realize the intelligent development of the bottom layer of the device. The proposal of a concept and idea is also an important development direction of artificial intelligence technology in the future. The above research shows that while using high-performance computer hardware for artificial intelligence software design and application, intelligent algorithms can also be transferred to the chip circuit level. For example, on the basis of the past, further simulation and development of the brain's neural pathways and integration with information processing capabilities Circuit.
6. Application of artificial intelligence technology in integrated circuits

6.1. Fault analysis and diagnosis
It is inevitable that electrical equipment failures will inevitably occur during the entire integrated circuit operation process. The root cause of such problems is that people did not expect to analyze and evaluate the problems that may be encountered in the operation of the entire equipment during the integrated circuit system failure design. The introduction of artificial intelligence technology into the integrated circuit system can scientifically and reasonably evaluate the operation failure of the integrated circuit with the help of technological advantages. Take the three-phase rectifier circuit as an example. With the help of intelligent technology, the fault type, fault element code and neural network output are corresponded. Aiming at the waveform sampling situation of the output voltage of the rectifier device, the sampled data is processed as a neural network and inputted through the neural network. After learning, the consistency of the input information and the fault meta coding is created, so as to realize the intelligent diagnosis of the rectifier device[8]. For example, in the process of a certain machine movement, the PLC input addresses corresponding to two limit switches are X001 and x002 respectively, and the two signals will not be in the NO state at the same time. If they are in the NO state at the same time, it means that at least one limit switch is stuck and should be shut down for processing. For example, in the ladder diagram in Figure 2, the normally open contacts X001 and X002 of the input relay corresponding to the two limit switches are connected in series to drive an auxiliary relay MO that indicates a limit switch failure. When MO is in the NO state, an alarm is issued Signal or stop signal.

Figure 2. Error detection program

6.2. Circuit system optimization design
The operation and management of integrated circuit electrical equipment involves complex design procedures, which puts forward higher requirements on the operating skills and professional knowledge of circuit designers, that is, they are required to have a comprehensive grasp of motors, Knowledge of electric circuits, electromagnetic fields, electric power information technology, etc. Although manual operation is a common method of electrical equipment management, with the progress of the times, the magical operation method of building a building will also face more problems, such as the design plan does not meet the standard, and the plan is difficult to modify after it is designed. Under the influence of artificial intelligence technology, computer software can be used to adjust and design plans, such as the application of artificial intelligence technology to the design of drawing design software, thereby effectively improving the accuracy and practicability of the entire design plan. For example, when performing integrated circuit operation and control, the intelligent CAD system can input user information, obtain more information from the computer's previous knowledge and reasoning, and enhance the rationality and convenience of system interaction[9].

6.3. Control and protection of integrated circuits
Under the action of artificial intelligence technology, it can collect and sort integrated circuit switching and analog data information in real time. At the same time, under the influence of artificial intelligence, integrated circuits can be pre-designed, and relevant information can be sorted and processed in batches, so as to truly and clearly reflect the actual application of some electrical equipment. To ensure the safety of the entire control process in integrated circuit control, it is necessary to control every control process and control node, and ensure the production of high-quality products through management and control of every detail, and realize refined management[10].
7. Conclusion
At present, in terms of circuit simulation, the automation application of artificial intelligence technology is better, but its smart model needs to be strengthened. But I believe that the application of artificial intelligence technology in circuit logic simulation will be more proficient and perfect in the near future.

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