

Research on the Manufacturability Simulation System of PCB in Experiment

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Abstract. Because of the disconnection between the printed circuit board design and the manufacturing in the comprehensive experimental circuit. A novel method for the simulation design in the stage of the experimental board is proposed. Combined with the related project practice, a simulation model system of EDA software is introduced. The experimental results show that the manufacturability simulation system using the printed circuit board can improve the design level of the printed circuit board in the comprehensive experimental circuit. It meets the requirements of the high quality and the low cost of teaching.

Introduction

At present, there is no unified data exchange standard and the design flow for the design and the manufacture of the printed circuit board (PCB) [1]. In practice, different CAD output file formats are required in the manufacturing stage [2]. So it caused the drawbacks of the non-uniform standards and the extended manufacturing cycles.

Based on the above issues, the printed circuit board designed by the electronic design automation (EDA) software adapted to the data interface with the different EDA software [3]. After the conversion of the *.cad file, the input file of the dedicated offline programming software is achieved. It could accomplish the offline programming. With the detailed analysis of the PCB component object, the data structure for the comprehensive electrical experiment in the universities is designed. Then a practical surface mount technology (SMT) simulation system is established to realize the visual dynamic simulation of the SMT process flow. At the same time, the analysis of PCB software and the error tips are obtained.

PCB Manufacturability Design

The PCB manufacturability design simulation is a dynamic simulation of the actual SMT of the PCB. Driven by the PCB files provided by the engineer, the output of the 3D simulation results is realized through the system analysis verification and the information extraction. It could provide the direct basis for the PCB data modification and achieve the optimal design.

The PCB manufacturability design simulation system mainly includes the EDA file format conversion, the *.cad file generation, the database maintenance, the simulation output module, the error tips and the output module. The framework of the system is shown in Figure 1:

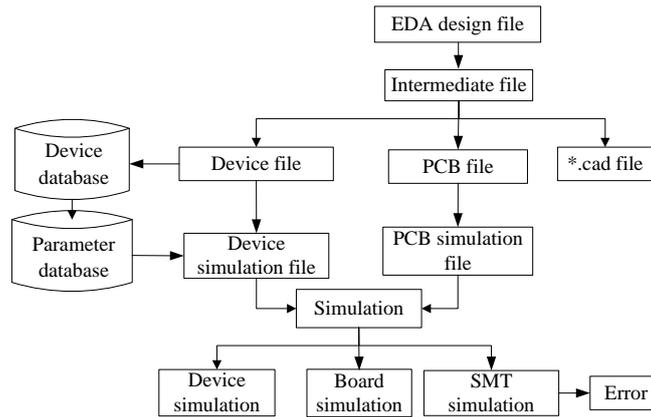


Figure 1 System module schematic

SMT Design Simulation and Implementation of PCB

In order to static, analysis and query the real-time operating conditions, the faults, repairs, tasks and the other manufacturing information of the equipment, the collected manufacturing data is processed by statistics, visualization and other technologies. The data is converted into the graphics, the datasheets and the animations. It achieves the deeper analysis of the equipment information. At the same time, it could strengthen the process management and improve the monitoring ability of the production process. The entire software system is divided into three modules: the collecting data, the offline analysis and the querying data, which as showed in Figure 2.

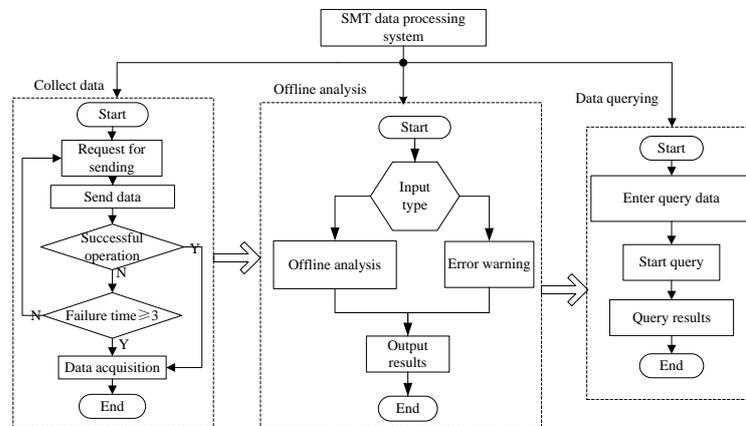


Figure 2 SMT simulation system data flow chart

The acquisition data module is issued by the client to set the frequency of the collected data. It obtain the important parameters of the relevant equipment from the data acquisition system. The data include the warning information in the production which is displayed on the client and save the data to the server's database. The offline analysis module is issued by the client to perform offline analysis of the device, the product performance and the error warning in the server database. At the same time, it displays the analysis result on the client. The query data module is input by the client to type the data to be queried, the specific time of occurrence and the corresponding information in the server database. The results are displayed on the client.

The Implementation and Testing of SMT Simulation System

Data process and welding SMT system. The system uses Microsoft Visual C++ 6.0 integrated development environment for programming through the SQL Server 2000. It realizes the client-server

working mode and connects with the Internet. The system has strong scalability and availability as well as the enterprise-class database and the data warehousing capabilities.

The processing functions of the visual display, the information statistics, the analysis and the query of SMT key data can be realized in this system. When the PCB enters into the SMT machine, the device parameter and the machine file are required. With the correct relevant information of the PCB board and the SMT file, the system can enter the welding procedure. In order to reduce the welding cost and improve the welding efficiency, the reflow soldering is completed to complete the soldering work of the PCB device.

Implementation of Visual System Testing. In the system for manufacturing the PCB, it is necessary to perform the flying probe tests for the PCB electrical characteristics in time. In common, moving four to eight independently controlled probes to the components. In order to test the components in the tested unit, the test probe is connected to the power source, the signal source, the multimeter and the frequency meter through a multiplex system. When a component is being tested, the other components in the unit are electrically shielded by the probe. It prevents the reading data is interfered. The goal of the flying probe test is to extract the short circuit, the open circuit and the other uncompliant devices from the flying probe test. With comparing all the tested device, it could obtain the quality of the PCB.

Comparison of test results. The test results are recorded in a *.ter file where the failed device name is saved. For example, the contents of a .ter file are as follows:

C₄₀ R₁ Q₁₀₃ ZNR₂ U₄ SHORT 51-98 K₁ R₄₅//C₃₆

In this file, C40, R1, Q103, ZNR2, U4, K1, R45//C36 are the devices names that failed the test, and the statement SHORT 51-98 indicates a short circuit between channels 51 and 98.

Therefore, the manufacturability design system marks the errors occurring in the design file by its own error correction function. The system could submit the result formation report to the user automatically.

Conclusion

With the computer simulation technology, using the data interface in different EDA software and analysis of the PCB component objects, a set of mounting simulation system suitable for comprehensive experimental circuit design is established. It is useful for design and manufacturing process. The data is extracted, detected, inquired, analyzed and visualized. The problems in the circuit design and production are found. So the reliability and yield of the design are improved.

Acknowledge

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