Exploration of Training Mode for EMC Technicians in Beijing Tianjin Hebei Region

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Keywords: EMC technology, Cultivating of applied Technicians, Innovation by production, Scientific research and teaching cooperation.

Abstract. Through analyzing the electromagnetic compatibility technology development level in colleges and universities, research institutes of special industry at Beijing, Tianjin and Hebei region are summarized. Combined with the joint construction by Hebei, Tianjin and Ministry of Education and first-class university building for Hebei University of Technology in Hebei province, A-list subject construction of Electronic Science and technology target is proposed. At the same time in development of an opening electromagnetic environment and electromagnetic compatibility research platform, teaching mode of practical personnel in the field of electromagnetic compatibility is explored. Through Innovation by Production, scientific research and teaching cooperation, EMC testing technical level of undergraduate is improved, EMC design rectification level of graduate is enhanced, and technical reserve and EMC talents are prepared to support the development of the industry of EMC in Beijing, Tianjin and Hebei region.

Introduction

With the rapid development and implementation of China's electronic products to the international market, the EMC detection and certification of electronic products are not limited to the scope of recognition in the domestic market. The integration of international accreditation standards is the urgent demand of many electric enterprises. The stable enterprises have always attached great importance to the development and accumulation of EMC technology, and formed a perfect system. However, these emerging electronic industries lack accumulation, and the contradiction between the technology of electromagnetic compatibility and the demand for talents is more obvious. But the investment in the system platform of EMC testing equipment is huge, and many small and medium-sized enterprises are difficult to invest. It has become a pressing problem to be solved urgently of the current electromagnetic compatibility industry in at Beijing, Tianjin and Hebei [1].

Electronic information, based on Electronic Science and technology, is the fastest developing industry. As the foundation and heart of modern industry, the new generation of electronic information technology has brought great impetus to the development of society, and has become an important indicator of the overall strength of the country. The “13\textsuperscript{th} Five-Year” National Science and technology development plan will support the developing of IC equipment, semiconductor devices and optoelectronic devices to form the new generation of information technology. “Beijing Tianjin Hebei” area has become one of the three largest gathering areas of China's electronic information industry. With the development of electronic information technology, electronic devices and electronic products, electromagnetic compatibility of the products also needs to be improved, and the electromagnetic compatibility technology based on the Institute of higher education in Beijing Tianjin Hebei has made great progress.

EMC Research Platform in Hebei University of Technology

At School of electronics and information engineering in Hebei University of Technology, researchers aims at the key technologies of electromagnetic compatibility in smart grid, instrumentation, rail
traffic, automotive electronics, medical electronics and other industries. Students are trained with engineering practice ability, and cooperation between school and enterprise are carried out. Aims to solve practical problems for enterprises, the content for EMC technologies includes “high precision electromagnetic compatibility testing”, “electromagnetic compatibility standardization test”, “electromagnetic compatibility technology optimization solution”, “electromagnetic compatibility technology training and consulting service”. Business cooperation with famous enterprises has been engaged. We have carried out scientific research work with the electronic products testing center of Hebei Province, and built the “electromagnetic environment and EMC laboratory”.

The laboratory has a full range of electromagnetic compatibility testing equipment and testing instruments, including 26.5GHz EMI receiver, electrostatic discharge test system, GTEM chamber radiation immunity test system, integrated circuit electromagnetic compatibility test system, EMSCAN electric field distribution scanner. The application of antenna, wave propagation and EMC related technologies can be researched, including rapid numerical calculation of electromagnetic field, new antenna construction technology and application, electromagnetic radiation and scattering characteristics in complex environment, electromagnetic interference suppression in communication system and communication platform, physical reliability and integrated electromagnetic protection technology [2]. Some EMC testing instruments in Hebei University of Technology are shown in Figure 1.

![Figure 1. EMC testing instruments in Hebei University of Technology.](image)

**Training Mode for EMC Technicians**

Responsibility of Hebei University of Technology is serving regional science and technology enterprises and promoting regional economic construction. Teachers make clear the objective of teaching task to cultivate students' practical application ability and build practical teaching mode to enhance students' innovative ability in practice [3]. As a practical field, electromagnetic compatibility technology must be closely integrated with engineering practice. In order to make the training of talents in universities to be better connected to the enterprise, the course of communication signal measurement technology for the graduate student is offered to practice the operation of the instrument and equipment. Adopting the form of enterprise project cooperation, the undergraduate students and master graduate students participate in the electromagnetic concurrent test and rectification process of the enterprise electronic products [4]. Students understand the EMC test standard and test equipment well, and improve their practical ability to analyze and solve problems.

**Postgraduate Students Are Responsible for Design and Rectification**

Through the accumulation of undergraduate study period, the basic knowledge of postgraduate students is rich, and the methods of operation and the implementation of the test standards are mastered. Therefore, in the process of developing the project with the enterprise, postgraduate students' master is design and rectification. According to the analysis of the test results, the postgraduate student should find the electromagnetic compatibility problems of the project, and put forward the improvement method according to the accumulated experience of circuit design and system design. The future employment direction of master's students is mainly to all kinds of research institutions, which can undertake the “electromagnetic compatibility technology optimization
solution”, “electromagnetic compatibility technology training and consulting service”, and can also provide a guiding work for the electromagnetic compatibility technology of enterprise in the electromagnetic compatibility Department of the enterprise.

Undergraduate Students Are Responsible for Standardized Testing

Different from the training for postgraduate students, undergraduate students have just contacted the curriculum of Electronic Science and technology. Many basic knowledge and theoretical principles have not yet been studied. However, the undergraduates have high enthusiasm and interest in learning, and have a fast grasp of new knowledge and new technology. At this time, the simple and dull teaching method has influenced the students' learning enthusiasm. In this case, the teaching method is introduced to let the students learn in practice, combined with the actual project, and let the students master the use of EMC instruments and equipment in the course of the project and the testing methods of the international standards of electromagnetic compatibility test in different industries, and master the knowledge in the process of repeated testing [5].

Cases of EMC Test and Rectification

Through the collaborative innovation teaching mode of production, learning and research, cooperation with enterprises, many successful cases have been obtained. Two successful cases are given below.

Elimination of Interference from Power Supply of PCB Board

The students adopt the electromagnetic interference scanner (EMSCAN HX-45) to determine the spatial distribution of the electric field on the circuit board, and find that the field intensity distribution of the power supply part on the circuit board is stronger and interferes with the work of other parts. Adjust the device or adjust the wiring of the circuit board to eliminate interference. Figure 2(a) and Figure 2(b) show the distribution of electric field in the circuit board before and after rectification. It can be seen from Figure 2(b), after the rectification, the interference problem of the lower left part of the power supply can be eliminated.

![Figure 2. Distribution of electric field in the circuit board before and after rectification.](image)

Elimination of 430MHz Interference Signal in 860MHz Signal

In the experiment, we should eliminate the scrambling signal of 430MHz in the signal. The master and the undergraduate should work together, according to the principle of signal modulation and demodulation, the improvement of the circuit board design and the use of the instrument and equipment of the scientific research platform to build the experimental system, verify the experimental method and through the improvement of the electric power. The 430MHz interference
signal is extracted and filtered to solve this engineering problem. Figure 3 shows the spectrum diagram of eliminating the scrambling 430MHz signal.

Figure 3. Spectrum diagram of eliminating the scrambling 430MHz signal.

Summary

To adapt the process of integration of Beijing, Tianjin and Hebei, we should increase communication with well-known universities in Beijing and Tianjin, promote academic exchanges, communicate with enterprises. Through scientific research projects, by introducing the cases of electromagnetic compatibility design and rectification of electronic products into practical teaching, the content of classroom teaching is enriched. Through real projects, research contents and research methods, by improving the quality of course teaching and cultivate, students can create new practice ability, and acquire deeply theoretical understanding and practical application.

Acknowledgement

This research was financially supported by the Hebei Province Professional Degree Postgraduate Teaching Case Construction Foundation (No.KCJSZ2017009).

References