

日本에서의 Power Electronics 및 전기동력技術의 現況과 展望  
STATE OF THE ART ON POWER ELECTRONICS AND ELECTRICAL DRIVES  
IN JAPAN

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Development of power electronics in Japan Started just after the advent of thyristors in 1957 from U.S.A. In 1960s, a tremendous amount of development had been carried out in the area of power electronics in Japan.

Power electronics technology was successfully applied in steel and other metal industry, railway traction drives, textile industry, paper industry, machine tools, electrochemical industry, lighting control etc. Power electronics, at that time, was established as an important part of fundamental technology which supports an modern industrial society.

In late 1970's, however, power electronics technology had got into a new phase. Japanese manufacturers began supplying new high performance power semiconductor devices such as GTOs, high power bipolar transistors, MOSFETs, etc.. Microprocessors became commercially available as control devices of power electronic system. High energy cost after the first energy crisis in 1973 accelerated the use of AC variable speed drives for energy saving. Thus we have expereinced the second revolution in the area of power electronics. The key topics of the revolution have been;

- High performance power converter based on high speed power devices
- Wide, practical applications of AC drives
- Precise motion control through  $\mu$ p-based controller
- Applications of modern control theory

These above mentioned topics will be still promising for manufacturers. However, university people consider that these topics will be completed in a few years at least univesity level. They are now serious in looking for new topics for the possible third revolution or they are now planning to change their area to other field.

The special features of power electronics in Japan have been;

- LSI technology has given a great impact to the development of power semiconductor devices
- Energy and labor saving is indispensable
- Customers like to use high technology for practical applications
- Extremely hard competition among power electronics manufacturers
- Students are well trained in up-technology
- Good cooperation system between companies and universities
- Unilateral technical information flow between Japan and the other part of the world

Looking back at the history of power electronics of Japan, most of key elements of power electronics technology came from outside of Japan. Thyristors and other power semiconductor devices are basically American inventions. Power converter circuits were mainly developed in USA, Vector control of induction motors is a German invention. Microprocessors are originally Japanese invention, but they have been developed in USA. Modern control theories are from Russia and USA. In spite of these facts, the special situation of Japan mentioned above brought Japan to one of the leading countries in the area of power electronics.

This paper describes the state of the art on power electronics and electrical drives in Japan together with the special circumstances of Japan where Japanese power electronics engineers are placed.