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Research on Application of Power Electronic Technology in Switching Power Supply

Xie Chen

China Electronics Technology Group Corporation 18th Research Institute Tianjin 300384

Abstract: Power electronic technology has been widely used in today's society, and has played an irreplaceable role in improving the development and living standard. With the rapid development of China's space engineering, power electronic technology in the switching power supply applications also promote the spacecraft to miniaturization and high-power development. High frequency, modular, intelligent, energy-saving, and so must be included, including space power, switching power supply, including the future direction of application. Believe that the future, power electronics in the switching power supply applications will be further breakthroughs, the need to further strengthen its research. Based on this paper, the application of power electronics technology in switching power supply is analyzed.

Key words: power electronics technology; switching power supply; application

1. Power electronics technology development and characteristics analysis

Power electronics technology is the application of electronic technology in the power system to ensure the stable operation of the power system to improve the quality of power supply system. With the continuous improvement of the level of science and technology, many new materials have been applied and the power system, which provides support for the application of power electronic technology in power system, the application of power electronic technology in power system, realizes the effective control of electric power, Users can more easily use the power. In the modern power system, the application of power electronics technology is essential, power electronic technology, including the material during the manufacturing technology and electronic circuit converter technology. The development of power electronics technology has experienced the first generation of semi-control power electronic technology, the second generation of the whole control of power electronic technology and the third generation of complex power electronic technology, power electronics technology is the main direction of development of low-power integrated circuits[1]. Low-power integrated circuit technology to drive, control and power device technology together, the biggest advantage is to reduce power. With the application of self-shutting device, high frequency has become the development direction of power electronic technology, power electronic control technology in the new stage of application also includes no power in power control and neuron control are currently in power electronic control technology. The traditional analog control has been unable to meet the needs of the development of power electronics technology, replaced by the microprocessor digital control technology.

2. The introduction of switching power supply

2.1 Switching power supply classification

① According to the type of input and output, the switching power supply is divided into DC/DC and AC/DC converter two. ② Can be driven by the different ways to switch power is divided into self-excitation and He-type two. ③ According to the different control methods, the switching power supply is divided into three: First, the pulse width modulation (PWM); Second, the pulse frequency modulation (PFM); Third, pulse width modulation and pulse frequency modulation mixed. ④ According

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to the circuit composition can switch power is divided into resonant and non-resonant type.

In addition to the above four categories, but also the switching power supply can be divided into single-ended forward and single-ended flyback; push-type and buck, boost or push-down and so on.

2.2 The development trend of switching power supply

Switching power supply gradually toward the high frequency, high reliability, low power consumption and low noise direction, and constantly improve their own anti-jamming and modularity[2] Now the market switching power supply, mainly the use of bipolar transistor made of the need to further improve its frequency, and also to improve the switching frequency, through the use of high-speed switching components to achieve. In order to effectively ensure the efficiency of switching power supply, need to continue to reduce the loss of the switch. After increasing the switching speed, the inductor and capacitor in the power supply circuit and the stored charge in the diode are affected, resulting in a surge or noisy. Therefore, in order to effectively control the surge, it is necessary to analyze different situations, using R-C or L-C buffer and amorphous magnetic core made of magnetic buffer and resonant. Resonant switches can help reduce losses when conducting surge control[3].

In order to pursue the high frequency of the switching power supply, it may cause the increase of noise. Therefore, it is necessary to adopt the resonant conversion circuit technology to reduce the noise while realizing the high frequency, but there are practical problems, so it is necessary to carry on the continuous research.

3. Power electronics technology in the switching power supply applications

3.1 Technical applications

3.1.1 Soft-switching technology

IGBT power device control of the PWM power supply can overcome the traditional high-power power inverter main circuit structure of the high energy consumption problem is reduced energy consumption by 30% -40%[4]. Soft-switching technology uses the principle of resonance, to overcome the traditional circuit using the buffer circuit to eliminate voltage spikes and surge current problems, so that the system tends to be simple, reduce the possibility of failure. The traditional circuit in the switch start and close the moment will produce a great deal of current and voltage, instantaneous voltage cannot be effectively used, thereby increasing energy consumption.

3.1.2 Synchronous rectification technology

Synchronous rectification technology in the soft-switching on the basis of further enhance the efficiency of the technology, which by rectifier switching diode metal insulator-semi-conductive tube reverse, suitable for low-voltage, high current power supply. The synchronous current is driven by a zero-voltage switch and a zero-current switch which drives the synchronous rectified pulse signal in conjunction with the initial pulse signal to raise its rising edge beyond the original rising edge to reduce the delay to achieve the metal-oxide-semiconductor field-effect transistor and zero voltage switch mode.

3.1.3 Control technology

The design of the main circuit must meet the structure of the switching converter is different from the characteristics of discrete nonlinearity, so the use of multi-channel switching power supply control. The dynamics of the switching power supply can be controlled by the increase and decrease of the electronic movement and the time period. The intelligentity of the switching power supply can be realized by the genetic algorithm} BP algorithm, fuzzy control, computer control and artificial neural network. The development of MEMS technology has greatly improved the speed of microcomputer operation. The realization of digital module for microcomputer or DSP application to high power switch has promoted the realization of digitalization and high efficiency.

3.2 Uninterruptible power supply

Uninterruptible power supplies (UPSs) are a highly reliable, high-performance power supply for computers, communication systems, and those that require a non-disruptive occasion. Modern UPS universal use of pulse width modulation technology and power M0SFET, IGBT and other modern power electronic devices, the introduction of microprocessor hardware and software technology makes it to achieve the intelligent management of UPS.

3.3 The inverter power supply

Inverter power supply is mainly used for AC motor frequency control, with Japan's Toshiba will be applied to this technology in air-conditioning technology, the domestic 90's began to use this

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frequency conversion technology, great savings in energy.

3.4 DC-DC converter

3.4.1 Communication power supply

The rapid development of the communications industry to promote the rapid development of the power industry, the current high frequency of small power supply is the mainstream of the communications industry. The wide range of integrated circuits used in communication equipment, power supply voltage according to different situations to use different, in the communication power supply system using high power density of high-frequency DC-DC isolated power supply module can reduce the loss, easy maintenance and installation[5].

3.4.2 Space power controller

Space power controller is one of the important components of the spacecraft power system. As a high power switching power supply, the main function is to transmit the electric energy generated by the solar panel to the spacecraft load through the electric energy conversion, and to charge and discharge the battery in time to maintain the spacecraft energy Balance and power supply bus stability. Taking into account the complexity of the space environment, the space power controller in addition to miniaturization, lightweight requirements, but also pay more attention to its reliability, therefore, industrial and civilian areas of power electronics technology in the field of space switching power applications to expand Perform a full validation and reliability assessment.

In short, although the development of power electronics technology has slowed down, and in the civilian areas become more mature, but in contrast, in the field of aerospace applications are still new, still has a strong application prospects. This paper analyzes the application of power electronic technology in switching power supply, with a view to the space switch power supply application development to provide some reference.

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