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Abstract

Harmonic Reduction and Power Factor Correction in Low Power Supply System

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In the recent years, capacitor rectifier circuits are widely used for the low DC power supply of many home applications and other electrical equipment, such as personal computer power supply, television sets power supply and etc. The main problems of this kind of circuits are high harmonic distortion and low power factor. The harmonic reduction in the power supply becomes a very important research topic due to the huge number of power supplies with very low power factors, which waste huge amount of energy in the world. There are many standards have been proposed to limit the harmonic distortion in the power systems, which will effect in the near feature. However, the PC power supplies in the market have do not meet the standard requirement yet. So the study on harmonic reduction and power factor correction in low power supply system is significant. The objective of this research is to seek for the best solution of harmonic reduction and power factor increment.

Traditionally, passive filters have been used to cope with the harmonic problems for their simplicity and low cost. But the compensation characteristics of the passive filters are highly sensitive to the change of the neighboring loads. It is not suitable to the low power switching mode power supply.

Various active filters have been proposed to mitigate the problems of the passive filters. We have developed a prototype of single-phase active power filter to evaluate the effect of harmonic reduction in switching mode power supply. Although the experiment results show that the Total Harmonic Distortion (THD) can be improved from 126% to 21%, it is still too high to meet the standards. So it can be concluded that the single-phase active power filter could not meet the standard requirement.

PFC technology has been used in high power supply systems to correct the power factor successfully. The technology has not been used in low power supply yet. Author usefully adopted boost PFC technology in low power supply for the harmonic correction and the power factor correction for several hundreds watts supply and made. The experiment results of the boost PFC technology can correct PC switching mode power supply's THD from 126% to 9%, and can also correct the power factor from 0.6 to 0.99. It can be concluded that boost PFC is the best solution of power factor correction for the low power switching mode power supply.

The author adopts a boost Power Factor Correction (PFC) technology to develop an active circuit for low power supply and made significant achievements in harmonic correction, and the power factor correction. The research work received a grate attention and positive feedbacks. This circuit has obtained the patent from China, in 2001. The project had been awarded the third prize of 7th Tiao Zhan Bei-The Chinese Students Competition on Science and Technology Project in 2001. Technology transfer is requested from one of the largest company of PC switching mode power supply in China in 2002. Four papers have been published, one paper on Kernel Journal and 3 papers on international conferences.