A SINGLE PHASE AC TO DC RECTIFIER EMPLOYING SOFT SWITCHING TECHNIQUE

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UNIVERSITI TEKNOLOGI MARA

MALAYSIA

NURUZANNA YAHAYA

Faculty of Electrical Engineering
UNIVERSITI TEKNOLOGO MARA
40450 Shah alam
Selangor Darul Ehsan

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ABSTRACT

A single phase AC to DC rectifier employing soft switching technique is simulated in this paper. The rectifier used is boost rectifier whereby we can achieve unity power factor, low total harmonic distortion and high efficiency. The soft switching technique in this rectifier is achieved using zero current switching during turn on while during turn off, it used zero voltage switching. In this paper, the rectifier and its modes of operation are explained. The method of control is assessed and the simulation results are obtained from doing a simulation of a boost rectifier using an IGBT switch.

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CHAPTER 1

INTRODUCTION

1.1 Hard switching and Soft Switching Techniques

In the 1970's, conventional PWM power converters were operated in a switched mode operation. Power switches have to cut off the load current within the turn-on and turn-off times under the hard switching conditions. Hard switching refers to the stressful switching behavior of the power electronic devices. The switching trajectory of a hard-switched power device is shown in Figure 1.1. During the turn-on and turn-off processes, the power device has to withstand high voltage arid current simultaneously, resulting in Tiigh switching losses and stress. Dissipative passive snubbers are usually added to the power circuits so that the dv/dt and di/dt of the power devices could be reduced, and the switching loss and stress are diverted to the passive snubbtfr circuits. However, the switching loss is proportional to the switching frequency, thus limiting the maximum switching frequency of the power converters. Typical converter switching frequency wals limited to a few tens of kilo-Hertz (typically 20 kHz to 50 kHz) in early 1980's.

In the 1980's, lots of research efforts were diverted towards the use of resonant converters. The concept was, to incorporate resonant tanks in the converters to create oscillatory (usually sinusoidal) voltage and/or current waveforms so that zero vbltage switching (ZVS) or zero current switching (ZCS) conditions can be created for the power switches. The reduction of switching loss and the continual improvement of power switches allow the switching frequency of the resonant converters to reach hundreds of