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A Technological Comparative Study of Two Different Pwm Chopper

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ABSTRACT

Recent year power electronics has been classified as an interdisciplinary technology that encloses power semiconductor devices, converter circuits, electrical machines, signal electronics etc. In this paper present the study of principal for some PWM AC chopper. PWM AC chopper have advantages, thus it can be used in a lot of industrial application. Generally PWM chopper have two types of application, first one is modern line conditioners represented, in this type chopper present boost, buck and buck-boost compensators are involve. The other one is cycloconverter made by PWM AC choppers.

KEYWORDS : AC chopper, AC-AC chopper, VSC, buck Converter

I. INTRODUCTION

The recent years increase the use of nonlinear loads as a results power quality have serious concern and therefore on the disturbances tolerated by sensitive electronics loads. At present, the line conditioners are mostly still rely on thyristor control technology. The harmonics current absorbs is present at high amplitudes and low frequencies. Considering these harmonics emplaced near to the fundamental harmonic at the power supply system. Passive filter is not recommended cause of its size, weight and price of the passive elements could be high. Hence, AC-AC direct converters with thyristors are placed outside of new electromagnetic compatibility standards that boundary the admitted perturbations in the power supply system [1]. Now a day, Line-commutated AC controller can be replaced by PWM (pulse width modulation) AC choppers, which have improved overall performance and the above problems can be improved but these controllers are designed to operate in the chopping mode. In this condition, the input voltage is chopped into segments and the output voltage level is determined by controlling the duty cycle of the chopper switching function.

To assure secure commutation without high voltage spikes, a few PWM control principles were developed in [3]-[4]. In this paper present some basic topologies of PWM AC choppers and buck type converter. PWM chopper have numerous advantages, such as: better power factor, quasi sinusoidal current waveforms, faster dynamics response and smaller input/output filters. Shown in figure 1 that the basic single phase PWM AC chopper is present.

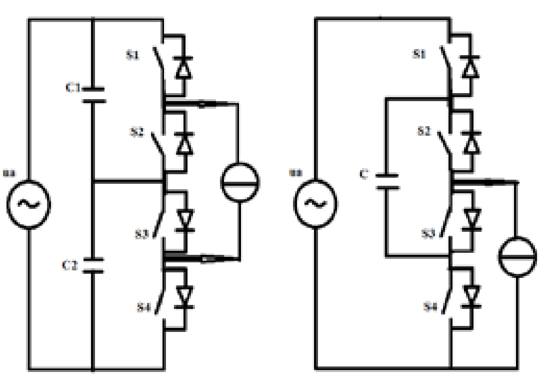

Figure 1 Basic Structure of 1-Φ PWM AC Chopper

II BASIC PULSE WIDTH MODULATION (PWM) AC CHOPER

Consider the supply mode: Pulse Width Modulation AC Choppers are described differential and non-differential topologies. These both topologies structures are made using two inverter commutation cells with bidirectional IGBTs in current and unidirectional in voltage. Absorb the energy stored in line stray inductor with DC snubbers are attached directly to commutation cells. These DC snubbers have a very simple structure, consisting of a capacitor only with no required for discharging resistors. The basic differential topology shown in figure 2 the S2 and S1 switches, the source voltage and the load are connected in sires. By Changing S2 switch between the source voltage and S1 switch non-differential topology is obtained shown in figure *b* [7]-[8].

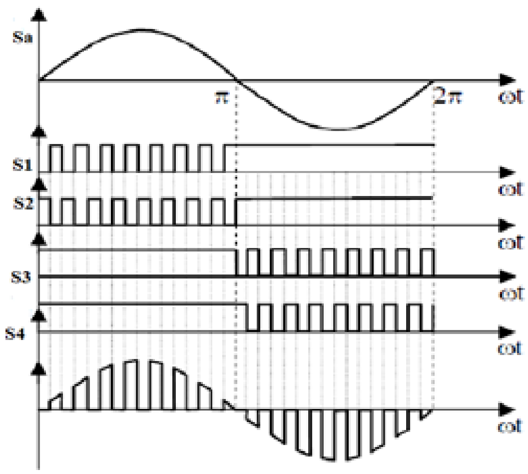

Figure 2 Control strategy waveform of PWM AC Chopper

1-Φ phase converters have the same control, depending on the source voltage *Sa* sign. Consider the case, if *Sa* is positive, then S2 and S1 switches are PWM controlled with a constant duty ratio (α), while S3 and S4 switches are fully turned on seen in figure 2. While the sign of the source voltage is changed, the switching pattern is reversed, S4 and S2 being corresponding PWM controlled with a constant duty ratio and S2 and S1 are fully turned on. In these switching patterns the path of current always exits whatever the inductor current direction. Throughout one switching cycle, basic AC choppers present main three possible operating modes: Active mode, Freewheeling mode and Bypass mode.

Active mode:
In this mode, the inductor current *iL* conducts during input and output side and provides output energy. The switches S1 and S2 are turned on and the inductor current conducts through S1 and the diode across S2 for *iL*>0 and also the diode across S1 for *iL*<0, as see in figure 4(*a*).

Freewheeling mode:
During this mode is complementary to the active mode. In this mode the switches S1c and S2c are turned on at that time the inductor current freewheels through the output side, as see in figure 4(*b*).

Bypass mode
The bypass mode is obligatory by non-linear system of power devices. To do not consider commutation problems through dead time, a particular control strategy for this type of conversion was proposed [5][6]. In this case two additional switches are turned on for safe com-

mutation. While the input voltage *Sa* is positive, the switches S2c and S2 are turned on for safe commutation. Consider the dead time the inductor current *iL* conducts in the positive direction through the load, the S2c switch and the diode across S1c and consider the negative inductor current *iL* conducts through the source voltage source, the S2 switch and the diode across S1.

The current paths in this mode, for Sa>0, are see in figure 3(c).

Three Phase PWM AC chopper:
Structures of single-phase topologies can be extended for three-phase structures. In three phase system, we are interested only in the mode of differential topology because of the numeral of commutation cells is two times smaller than the three phase non-differential topology [5], [9].

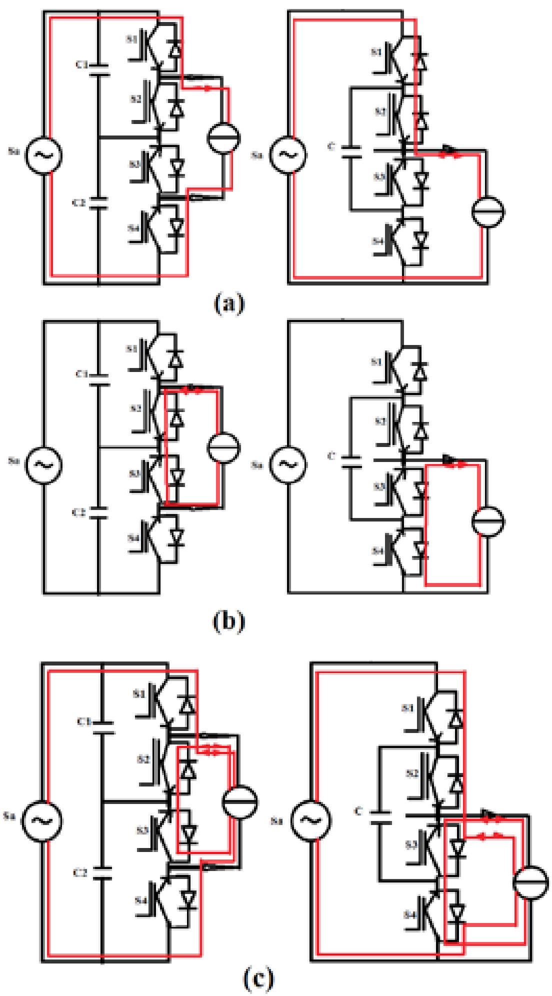

Figure 3 Current paths for operating mode of PWM AC Chopper

Now the first control strategy is depending on the current's sign, is realized by having identical duty cycles. In this control strategy only active and freewheeling operation modes are allowed. So that there is direct energy change similar to a bypass operating mode.

Common topologies of AC chopper like: Buck, the Boost, Buck-boost Z-source, and the quasi-Zsource and multi-level topology.

III Operation of Boost Chopper
The shown in figure 5 an basic diagram form of a step up chopper, its called as Boost chopper.

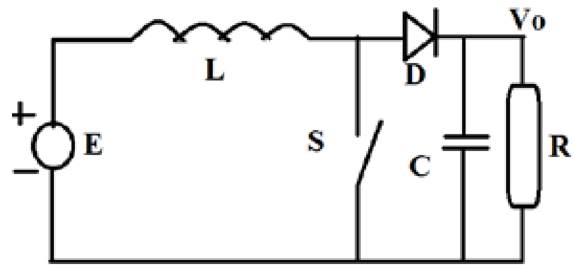

Figure 4 Basic Circuit diagram of Boost chopper

Basically Boost chopper, a large inductor L is connected in series with voltage source Vs is essential as seen in Figure 4. If the chopper is ON, i.e.., throughout the period Ton the inductor stores energy and if there is closed current path and the load voltage Vo is zero. Consequently during the interval Toff as the inductor current cannot pass on out directly, this current is forced through the diode and load. Appropriately, voltage across the load is given equation,

VO=Vs + L*(di/dt) ….1

Here exceeds the source voltage Vs representing a step up chopper.

From the equation for the output voltage of a boost chopper can be given as,

Vo= Vs*T/(T-Ton) = 1/(1- α)*Vs ….2

Here, T = Ton + Toff

Ton time, chopper is ON and load voltage is equal to voltage source 'Vs'. In the interval Toff time, the load current flows through the free-wheeling diode, therefore load terminals are short-circuited by free-wheeling diode and load voltage is therefore, zero during Toff time. Thus a D.C. chopped voltage is produced at the load terminals.

The equation of average load voltage 'Vo', is represented by,

Vo=Ton/(Ton+Toff)*Vs =(Ton/T)*Vs =α*Vs ….3

Here Ton=ON time and Toff=OFF time,

α =(Ton/T)=duty cycle

Accordingly, the load voltage can be controlled by varying the duty cycle 'α', which implies that when the input voltage 'Vs' is constant and the duty ratio 'α' is varied as desired, the output of Buck converter will be as that of 'α'

i.e.., vo = αvs ….4

Here 'α' represents the duty ratio.

Advantages of Buck Over Boost
The advantages of Buck Converter over Boost Converter are as mentioned below,

1. The output voltage of the boost converter is very sensitive to changes in duty cycle and it might be difficult to stabilize the regulator but this is not the case in Buck regulator.
2. The Buck converter topologies configuration is very simple and has high efficiency greater than 90%.
3. The averaged output current of Boost converter is less than the averaged inductor current by a factor of (α) and a much higher R.M.S current would flow in the filter capacitor, consequential in the use of large filter capacitor and a large inductor than a Buck converter.
4. Buck converter voltage gain is better than Boost converter.

IV THE DC-DC BUCK CONVERTER CHOPPER
Since the buck, boost, and buck-boost converters are the simplest

and most commonly used converters for power regulation, and also that Cuk, Sepic, and Zeta converters can be constructed by combining these converters. The basic operation of the buck converter is quite simple, with two switches (usually a transistor and a diode) that control the inductor. Using two switches; alternates between connecting the inductor to voltage source to store energy in the inductor and discharging the inductor into the load. Now see how the switching frequency works, the gain parameter of the energy storage elements of the converter and the type of the controller would affect the control performance of a converter. The basic buck converter circuit converts a higher dc input voltage to lower dc output voltage, it is illustrate in figure 6.

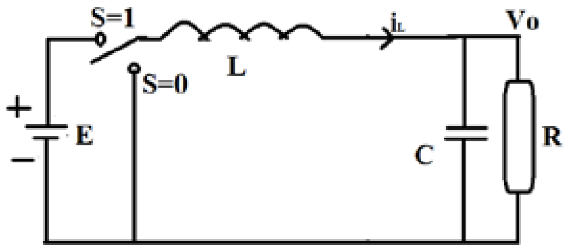

Figure 6 Basic Circuit diagram of

Buck Converter

Show the buck converter; while the switch is on position 1 the circuit is connected to the dc source input resulting an output voltage across the load resistor. When the switch changes its position 1 to position 0, at that time the capacitor voltage will discharge through the load. Controlling of switching position the voltage output can be maintained at a desired level lower than the input source voltage.

If S is the control input taking discrete values of 0 and 1 which described the switch position. When S = 0 condition is at position 0 and S = 1 if switch is at position 1. In this case, assumed that the inductor current will have a nonzero value due to load variations which is known as the CCM (continuous conduction mode).

Conclusion:

Conversion of Power is basically achieved by appropriate configuration of the D.C to D.C converter circuit components and proper operation of the semiconductor switches. Several D.C to D.C converters will be designed for precise load (output) and line (input voltage) conditions. Especially we say that the circuit will be operated at steady state condition.

During PWM (pulse width modulation) converters the regulates of control circuit the output by fixing the switching frequency and varying the on time of the switch, while on the other side in resonant switched mode, power supplies the control circuit regulates the output by varying the switching frequency and fixing the on or off time of the switch. To study the paper we conclude that the Buck controverter is better performance over the other types of converters.

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