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DC LINK CAPACITOR PERFORMANCE, PACKING AND TESTING

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Abstract— The high current testing of this device can be done without much power loss by using the parallel resonant technique, which gives the capacity of the capacitor for various current rating and its performance can be studied effectively with simple testing equipment's which is easy to handle. The cause of heating in the capacitor is resistance present in it, these values cannot be made to zero in practical, but it can be reduced by making the film thicker, by using thicker film the resistance value decrease. Inductance and resistance value of strut for fitting is made less by using copper with mix metals, cold curing epoxy resin to be used to remove the heat produced inside the element with proper packing.

Keywords -- AC and DC voltage , Frequency.

I. INTRODUCTION

In power conversion, when AC is converted to low voltage DC, or AC from one frequency to another, the AC is usually rectified and smoothed. Once this is accomplished, the power is then routed to an inverter to obtain the final output. The DC that is fed into the inverter is called the DC link. As the name implies, the two sources are linked together with a filter capacitor. So Capacitor should handle this high current during transient condition, otherwise this leads to the failure of the capacitor frequently, this can be avoided by proper selection of the capacitor, by increasing the performance of the capacitor. And the main cause of the device to be failure is heating of element due to its internal resistance to avoid this some special technique to be followed to dissipate the heat from the capacitor.

To overcome this problem and to protect the power electronics like IGBT, a good selection of capacitor is required for better system performance, the high current testing of this device can be done without much power loss by using the parallel resonant technique, which gives the capacity of the capacitor for various current rating and its performance can be studied effectively with simple testing equipment's which is easy to handle. The cause of heating in the capacitor is resistance present in it, these values cannot be made to zero in practical, but it can be reduced by making the film thicker, by using thicker film the resistance value decrease. Inductance and resistance value of strut for fitting is made less by using copper with mix metals, cold curing epoxy resin to be used to remove the heat produced inside the element with proper packing. So that life of capacitor can be increased.

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II. MOTIVATION AND OBJECTIVE

The simple diode bridge is well known as the most economic solution among all the rectifier topologies that are available. However, it suffers from the disadvantage of drawing higher ripple current from the utility. The diode rectifier also does not have a voltage-boosting capability, which limits its usefulness. A diode bridge used in combination with a boost chopper, however, removes some of these disadvantages. First of all, it inherits excellent boosting capability from the chopper, and the chopper can control the ripple current of the system up to a certain extent. Thus, the overall power factor of the system can be improved by adding the chopper. The cost of such a single-switch rectifier-chopper combination is much less than a six-switch active-boost rectifier, and the benefit of cost-effectiveness is largely retained. The diode-bridge with boost chopper combination can also be used for the rotor-side control of a wound-rotor induction machine when the rotor generates slip power (sub-synchronous motoring and super-synchronous generating modes). However, this topology does not support the rotor-side control when the rotor requires slip power (i.e., during subsynchronous generating and super-synchronous motoring) because the diode bridge does not have regenerative operation.

III. PRINCIPLE AND WORKING

In Figure.1 the circuit diagram of system is shown. The main working principle of the circuit is resonance, by the resonance condition the testing of the capacitor is made, at various frequency and rating of power. Electrical resonance occurs in an electric circuit at a particular resonant frequency when the imaginary parts of impedances or admittances of circuit elements cancel each other.

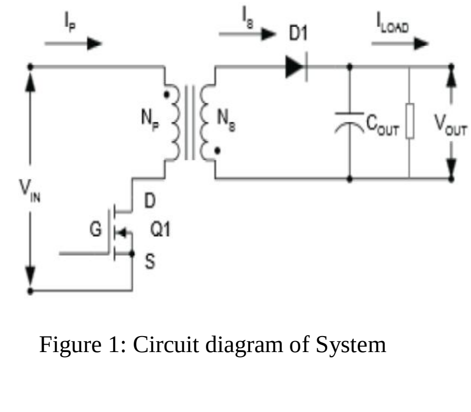

Figure 1: Circuit diagram of System

In some circuits this happens when the impedance between the input and output of the circuit is almost zero and the transfer function is close to one. Resonant circuits exhibit ringing and can generate higher voltages and currents than are fed into them. They are widely used in wireless (radio) transmission for both transmission and reception.

IV. BLOCK DIAGRAM AND ITS DESCRIPTIONS

The theory and concepts related to the SMPS and fly back converter are covered as the first step of thesis. The converter circuitry is designed by dividing the circuit in main modules such as power supply section, control section, switching circuitry and planar transformer circuit section. These sections contain a network of components and values for these components are selected by theoretical calculations.

High frequency accelerated aging: Most accelerated dielectric aging data in the literature specifically for capacitors have been measured at line frequencies (50/60 Hz) and are evaluated. These models typically assume a factor of two acceleration with every 8 to 10°C above the maximum ambient rating and a power law for the voltage acceleration with an exponent in the 8 to 15 range. Capacitance change is used as a figure of merit and reflects both clearing events and corrosion. For power electronics where capacitors can be exposed to high frequency AC power (15 to 75 KHz are very common) and high frequency ripple power (15 to 250 KHz are very common), accelerated aging must be done at the actual high frequency. Using a high frequency power amplifier driven by a function generator to produce the high frequency accelerated aging power. A typical test circuit is operated in either a series resonant or a parallel resonant mode. For high voltage circuits, the series resonant configuration is used. For high current (many capacitors in parallel or large value capacitors) circuits, the parallel configuration is usedThe input and output voltages of fly-back converter is senses through voltage measuring circuits. The analog to digital converters are used to convert the analog signals which are measured by voltage measuring circuits into the digital signals. Based on output of the analog to digital converter the embedded system generates the pulses. The asymmetric forward DC-DC to converter to regulate the output voltage according to the pulses generated by the embedded system.

The project has its focus on analyzing the behavior of the converter in respect of output power, efficiency and increasing the range of input voltage in an open loop circuit design. The converter application is completely based on DC to DC step down voltage conversion (depending on transformer turns ratio).

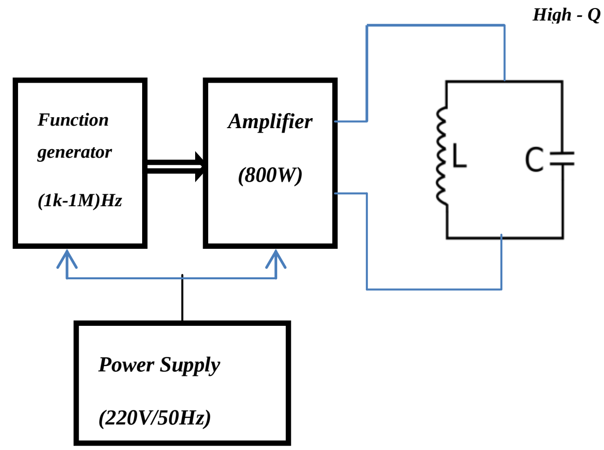

Figure 2: Block Diagram of Proposed System

V. SIMULATION RESULTS

For simulation SPICE software is used which is a general-purpose, open source analog electronic circuit simulator. It is a program used in integrated circuit and board-level design to check the integrity of circuit designs and to predict circuit behavior.

Unlike board-level designs composed of discrete parts, it is not practical to breadboard integrated circuits before manufacture. Further, the high costs of photolithographic masks and other manufacturing prerequisites make it essential to design the circuit to be as close to perfect as possible before the integrated circuit is first built. Simulating the circuit with SPICE is the industry-standard way to verify circuit operation at the transistor level before committing to manufacturing an integrated circuit, oscillations at a constant level. The amount of energy replaced must therefore be equal to the energy lost during each cycle.

If the energy replaced is too large the amplitude would increase until clipping of the supply rails occurs. Alternatively, if the amount of energy replaced is too small the amplitude would eventually decrease to zero over time and the oscillations would stop.

To maintain a stable oscillation the overall gain of the circuit must be equal to one or unity. Any less and the oscillations will not start or die away to zero, any more the oscillations will occur but the amplitude will become clipped by the supply rails causing distortion.

For oscillations to exist an oscillator circuit must contain a reactive (frequency-dependant) component an Inductor or a Capacitor as well as a DC power source. In a simple inductor-capacitor, LC circuit, oscillations become damped over time due to component and circuit losses.

Losses and provide positive gain. The overall gain of the amplifier must be greater than one, unity. Oscillations can be maintained by feeding back some of the output voltage to the tuned circuit that is of the correct amplitude and in-phase, (0^o). Oscillations can only occur when the feedback is Positive (self-regeneration). The overall phase shift of the circuit must be zero or 360°.

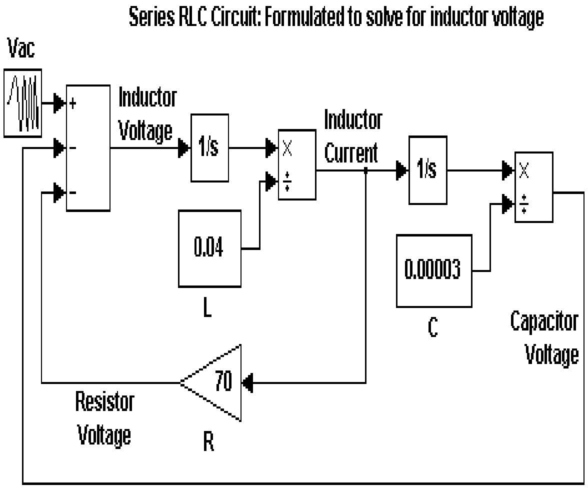

Figure 3: Simulation Circuit

A detailed simulation approach is utilized to evaluate the single cap/bus sourcing parallel inverter stages. The two-dimensional results presented previously are used as the basis for validating a complete three-dimensional model. A full three-dimensional analysis is shown Figure 4 and 5 show the output voltage and current using 68uF of capacitor (C1).The goals to achieve in this converter are Investigate the possibilities to implement high efficiency flyback converter above 70V using a a voltage doubler structure with a forward inductor L_f. and By selecting soft switching techniques that in result reduce the losses and increase the performance of the system. Investigate the efficiency of the converter under different conditions while working in range of high input voltages to achieve high efficiency.

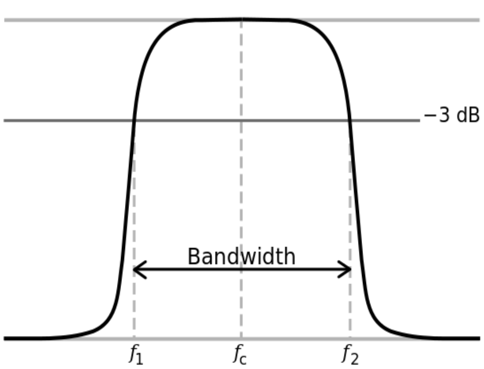

Figure 4: Current Waveform of Proposed Converter

Q factor is a parameter that describes the resonance behaviour of an underdamped the harmonic Voltage amplification is required to overcome these circuit then undertaken to consider the effect of bus heating and connection topology. Temperature rise testing of an instrumented capacitor/bus assembly subject to defined thermal boundary conditions and ripple current provides an empirical validation of the model. From this point, the model is utilized to consider a very high performance use case and compute the capacitor hotspot temperature subject to continuous and peak operating transients and heating of the bus conductors.

Selecting low loss (ultra low ESR) chip capacitors is an important consideration for virtually all RF circuit designs. Some examples of the advantages are listed below for several application types extended battery life is possible when using low loss capacitors in applications such as source bypassing and drain coupling in the final power amplifier stage of a handheld portable transmitter device. Capacitors exhibiting high ESR loss would consume and waste excessive battery power due to increased I^2 ESR loss.

Increased power output and higher efficiency from RF power amplifiers are more easily attainable with low loss capacitor products. Low loss RF chip capacitors used in matching applications, for example will maximize power output and efficiency of an amplifier. Many of these devices have exceptionally low input impedance whereby any ESR loss from the capacitor used in the input matching circuit can represent by a significant percentage of the total network impedance contained in oscillator circuit of the system. Sinusoidal driven by a circuit resonators having higher Q factors resonate with greater amplitudes (at the resonant frequency) but have a smaller range of frequencies around that frequency for which they resonate.

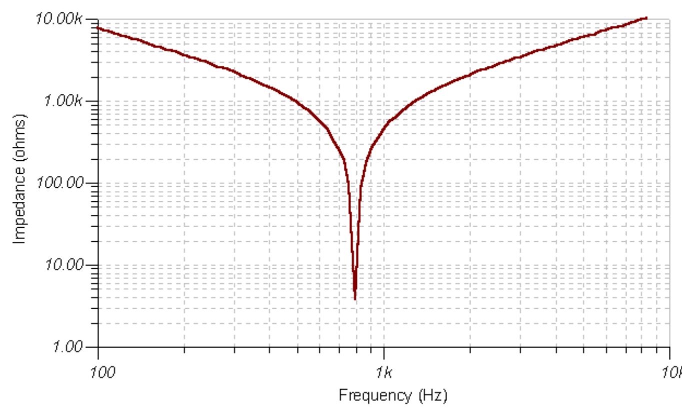

Figure 5: Output Voltage Waveform of Proposed Converter

The frequency response curve of a parallel resonance circuit shows that the magnitude of the current is a function of frequency and plotting this onto a graph shows us that the response starts at its maximum value, reaches its minimum value at the resonance frequency when IMIN = IR and then increases again to maximum as f becomes infinite.

VI. TESTING TECHNIQUE

Electrical resonance occurs in an electric circuit at a particular resonant frequency when the imaginary parts of impedances or admittances of circuit elements cancel each other. In some circuits this happens when the impedance between the input and output of the circuit is almost zero and the transfer function is close to one. Resonant circuits exhibit ringing and can generate higher voltages and currents than are fed into them. They are widely used in wireless (radio) transmission for both transmission and reception.

Resonance of a circuit involving capacitors and inductors occurs because the collapsing magnetic field of the inductor generates an electric current in its windings that charges the capacitor, and then the discharging capacitor provides an electric current that builds the magnetic field in the inductor. This process is repeated continually.

At resonance, the series impedance of the two elements is at a minimum and the parallel impedance is at maximum. Resonance is used for tuning and filtering, because it occurs at a particular frequency for given values of inductance and capacitance. It can be detrimental to the operation of communications circuits by causing unwanted sustained and transient oscillations that may cause noise, signal distortion, and damage to circuit elements.

Parallel resonance or near-to-resonance circuits can be used to prevent the waste of electrical energy, which would otherwise occur while the inductor built its field or the capacitor charged and discharged. As an example, asynchronous motors waste inductive current while synchronous ones waste capacitive current. The use of the two types in parallel makes the inductor feed the capacitor, and vice versa, maintaining the same resonant current in the circuit, and converting all the current into useful work. Since the inductive reactance and the capacitive reactance are of equal magnitude.

VII. CONCLUSION

Thus high current testing of this device can be done without much power loss by using the parallel resonant technique, which gives the capacity of the capacitor for various current rating and its performance can be studied effectively with simple testing equipment's which is easy to handle. The cause of heating in the capacitor is resistance present in it, these values cannot be made to zero in practical, but it can be reduced by making the film thicker, by using thicker film the resistance value decrease. Inductance and resistance value of strut for fitting is made less by using copper with mix metals, cold curing epoxy resin to be used to remove the heat produced inside the element with proper packing.

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