**ABSTRACT**

Power Converters are extensively employed in most of the power conversion system. Power converters are power electronics circuits comprised of energy storage elements like L, C, load components and one or more semiconductor switches. The semiconductor devices are opened or closed to achieve power conversion.

This thesis work is framed with the following objectives

1. Development and analysis of various EMI suppression technique for DC-DC boost converter.


3. Implementation of optimization algorithm based on bacterial foraging technique for chaos minimization.

The design and performance analysis of periodically switched DC-DC boost converter is studied in chapter 2. The boost converter for the specific switching frequency is designed and simulated for the performance investigation on the converter. It is observed that, with periodic operation of the converter intolerable EMI peaks are generated that degrade the system performance and ruin the Electro Magnetic Compatibility of the system. With the undesirable variation of the system parameter, the system dynamics are disturbed, losing the equilibrium point of operation and leading to chaos-an aperiodic behavior leading to system instability. Proper measures have to be taken to avoid such degrading performances of boost converter and to ensure the performance integrity of the converter.

A new FPGA based chaotic carrier is proposed, to be used in PWM DC-DC converters, to reduce EMI. RCFMFD based Spread Spectrum technique is introduced to generate the chaotic PWM pulse. RCFMFD based PWM is implemented using Field Programmable Gate Array (FPGA) module. The effect of using RCFMFD based Spread Spectrum technique on the conducted noise characteristics of a DC-DC converter (boost converter) has been experimentally investigated. This scheme reduces the conducted noise peaks and also spreads it in a frequency range specified.
by the randomization scheme. This proposed EMI suppression scheme helps in achieving the Electromagnetic compatibility (EMC) standards for DC-DC converters.

A single stage CM EMI filter combined with FPGA based chaotic PWM technique is implemented and tested for suppression of EMI in DC-DC boost converter. The effect of using RCFMFD spread spectrum scheme along with EMI filter on the conducted noise characteristics of a DC-DC converter (boost converter) has been investigated both through simulation and experiments. This new scheme suppresses the conducted noise peaks by spreading the spectral power to a wider frequency range thereby reducing the risk of EMI impact on sensitive applications. In sensitive applications such as medical instrumentation, aircrafts etc., the chances of equipment malfunction, performance degradation and source of radiated emission will be greatly reduced. This proposed Electromagnetic Interference suppression scheme also helps in achieving the Improved Electromagnetic compatibility (EMC) in power supply unit.

The effect of using RCFMFD spread spectrum scheme along with soft switching on the conducted noise characteristics of a DC-DC converter (boost converter) has been investigated both through simulation and experiments. By analyzing the FFT characteristics of chaotic modulated soft switching boost converter, the spectral peaks are less and the power of the signal is distributed over the entire frequency band as compared to periodic soft switching boost converter where power is concentrated in a narrow band of frequency. Combining the soft switching technique with chaotic modulation, it was observed that the peaks could be eliminated without using bulky filters.

Controlling of undesirable chaotic behavior in solar fed DC-DC boost converter using optimal parameters is presented in this thesis. Well-known Bacterial Foraging Algorithm is enhanced with Nelder-Mead algorithm for optimizing the circuit parameters. The results were obtained using the proposed algorithm and compared with traditional methods. The bifurcation analysis proves that the proposed method is profoundly ensures the stable operation of variable input DC-DC boost converter for the reasonable operating region. This indeed shows the increased range of desirable operating spectrum making it suitable for applications involving solar energy. It is inferred that the proposed strategy replaces the complicated design and
dedicated auxiliary circuits involved in chaos control for the fast switching DC-DC power converters and thereby the stability and Electro Magnetic Compatibility (EMC) of the converter also improved significantly.

To summarize, this research work proposes an Integrated, effective and simplified methodology for suppressing the conducted Electro Magnetic Interference and chaos control in DC-DC boost converter. The boost converter is designed, fabricated and tested with different combination of well-known suppression techniques. The high frequency switching pulses are generated using well proven Field Programmable Gate Array technology. Further, in order to avoid the nonlinear behavior of the DC-DC boost converter during chaotic switching operation, the circuit parameters are optimized using Enhanced Bacterial Foraging Optimization Algorithm. The bifurcation analysis and FFT analysis ensures the chaos free operation of the system. The hardware and simulation results obtained validates the proposed chaos control and combined EMI suppression techniques. The proposed strategies can be applied for DC-DC converter used in applications such as electric vehicle, SMPS, power supplies which are more prone to chaotic behavior and problems.