PREFACE

High Power Microwaves (HPM) has drawn considerable attention in recent years as a new technology, allowing new strategic applications and offering innovative approaches to existing applications. Many of the HPM sources are being developed are derivatives of sources that are well known to the vacuum electronics community. HPM sources are being developed that provide peak powers that exceed 1GW at frequencies on the order of 1GHz in short pulses, typically on the order of 100ns. The technology that is used to drive such sources has its root in pulsed power and a comprehensive understanding of their behavior requires the use of tools that have been developed in the plasma physics community. Magnetically Insulated Line Oscillator (MILO) is one of the most stimulating device among all the cross field device family and has been now extrapolated to the high pulsed power microwave regime in the range of gigawatts. MILO is a compact, robust, and simple device which does not require external DC magnetic field for its operation.

MILO is basically a linear variant of the magnetron invented by M. Collins Clark during 1988 at Sandia National Laboratory, USA. It is a high power microwave source capable of delivering output power greater than 1GW at a frequency of 1-10GHz. Because high power microwave sources operating in gigawatt range of pulse length of ~ 100 ns to 1 μsec has applications in defense and plasma systems, there are continued interest in improving the output performance of the MILO which includes RF output power, pulse length, efficiency, cathode performance, and power extraction.

Initial research and development work on the magnetron was mainly concentrated at France, China and US, but with growing applications of this device, several other groups around the globe have also emerged out. In India, DRDO, Bangalore is indigenously putting its effort in the research and development of the MILO.

In the present thesis, studies have been made to improve and optimize RF interaction structure of MILO using equivalent circuit approach. This analysis is carried out both for the beam absent and present case for the disc-loaded coaxial waveguide structure. MILO structure has also been simulated using CST-PIC simulation technique. The results have been validated with the experimental data available in different literatures. Further, in order to improve the device power conversion efficiency different improvement techniques have been proposed and validated through the PIC simulation.