

PREFACE

Beam Technology Development Group has been involved in the design, development and deployment of various cutting edge technologies which are utilized in nuclear reactor, industry and strategic applications. It gives us a great pleasure in presenting the third volume of Beam Technology Development in BARC entitled, “Pulsed Power and Applications”. It is a collection of research & development outcome in the area of High Voltage Pulse Power Systems for last 40 years enumerating the history, fundamental design principles, simulation and indigenous development of building blocks of pulse power systems and their applications.

Pulse power activities were started at BARC, Mumbai way back in 1970s, with major emphasis on fusion studies. However, subsequently several other applications were identified both in industrial and strategic domain. The earliest pulse power systems developed were named as KALI, which stands for Kilo Ampere Linear Injector. The pulse power activities were mainly focused on intense relativistic electron beam generation using explosive field emission principle.

The application part of the intense relativistic electron beam for societal and strategic applications started in 2010. In 2010 magnetic switch based LIA-200 system was developed for repetitive applications. The KALI-30 GW system was also used to generate 1.2 R flash X-ray dose at 1.0 m distance from the rod pinch diode source for 1 MV, 10 kA electrical parameters in 2013. On the same system in 2015, 1.1 GW peak microwave was generated with S-band backward wave oscillator (BWO), which was a milestone in pulse power. The journey of developing few 100 MW to multi gigawatt microwave pulse power was challenging and competing with pulse power systems around the world.

In 1980s, the pulsed magnetic field generator found special applications positioning of garter springs in nuclear reactors. In mid-90s, magnetic pulse joining of thin metallic sheet components was imitated and a 20 kJ, 10 kV Electromagnetic Manufacturing Machine (EMM) was developed. By utilizing this machine, solid state welding was developed for Al clad to Al end plug welding for Dhruva research reactor. This technology has been transferred to Indian public and private industry. Many other applications of joining dissimilar metals like AA5052-SS304L both in compression and expansion joining were demonstrated for various reactor applications.

The young scientists and engineers would find the various chapters of this book beneficial and take forward to make advanced pulse power systems for departmental & societal applications.

We are grateful to our Department of Atomic Energy and Bhabha Atomic Research Centre for the vision and enabling the scientists and engineers to excel in this Pulse Power Technology and disseminate the knowledge to various departments. We owe sincere thanks to our seniors & mentors for their strong foundation, guidance and persuasion. We thank the Scientific Information and Resources Division, BARC for the endeavour in publishing this book.

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