

# Seminar

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## Institute for Plasma Research

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**Title:** Modelling, Simulation & Design of Modular Multilevel Converter

**Speaker:** Dr. Vivek Patel

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**Date:** 14<sup>th</sup> August 2024 (Wednesday)

**Time:** 03.30 PM

**Venue:** Committee Room 4, IPR

### Abstract

The Modular Multilevel Converter (MMC) is a power electronics device employed in high-voltage applications. Its recent prominence stems from its ability to manage high voltages, minimize harmonics, and enhance controllability. This work explores the modeling, simulation, and design of MMCs, focusing on their application in inverter and rectifier operations, as well as the innovative fractional-order modeling approach of MMC. The work discussion is structured into three main sections.

- 1. Modelling & Simulation of Modular Multilevel Converter (MMC) for Inverter Operation:** The initial section delves into the detailed modelling and simulation of MMCs when operating as inverters. This involves analysing the dynamic behaviour, efficiency, and stability under various load conditions. The results highlight the performance characteristics and potential advantages of MMCs in inverter applications.
  - 2. Design and Simulation of MMC for Rectifier Operation for Residual Ion Dump Supply (15kV/5A):** The next section focuses on the design and simulation of MMCs for rectifier operation, specifically for supplying a residual ion dump at 15kV/5A. This part covers the challenges of high-voltage rectification and component selection. The simulation results demonstrate the MMC's ability to provide reliable and efficient rectification, ensuring stable operation under demanding conditions.
  - 3. Fractional-Order Modelling of MMC:** The final section explores the innovative fractional-order modeling of MMCs. By integrating fractional-order calculus into the control strategy, the study aims to enhance the converter's accuracy and dynamic response. Simulation results underscore the improved performance and stability offered by this advanced modeling approach.
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