

Design Study of Line Inductor for Modular Multilevel Converter Rectifier

Abstract

This project will focus on design study methodology for the line inductor of a Modular Multilevel Converter (MMC) configured as a three-phase AC-DC rectifier for high-voltage DC power supply applications. The converter is fed from a three-phase, 415 V (line-to-line), 50 Hz supply. The line inductor limits arm current ripple, attenuates harmonic injection into the AC grid, and supports submodule capacitor voltage balancing. An analytical design expression is derived from the MMC arm current model, where the inductance value is determined by constraining the peak-to-peak arm current ripple to a defined percentage of rated arm current, accounting for submodule count per arm, submodule capacitor voltage, and effective converter switching frequency. The derived inductance is validated through steady-state ripple analysis and total harmonic distortion (THD) evaluation of the input line current. Simulation models developed in MATLAB/Simulink verify the analytically designed inductor under rated operating conditions. The results show that precise inductor sizing is necessary for achieving compliant power quality and stable high-voltage DC operation in MMC-based rectifier systems.

Academic Project Requirements:

- 1) Required No. of student(s) for academic project: 2
- 2) Name of course with branch/discipline: B.E./B.Tech. Electrical
- 3) Academic Project duration:
 - (a) Total academic project duration: 6 Weeks
 - (b) Student's presence at IPR for academic project work: 3 Full working Days per week

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