Master thesis

Investigating Nearest Level Modulation for Battery-integrated Modular Multilevel Converters.

Battery-integrated MMCs (BI-MMC) have gained popularity over the recent years in the research and development of EV power-trains due to their high efficiency and greater cell-level control. BI-MMCs can improve battery balancing, provide better battery fault isolation due to its highly modular structure, and potentially increase the lifetime of the battery pack.

A BI-MMC typically consists of either one or two arms per phase and each arm is made up of number of cascaded stages of DC—AC converters and are commonly referred to as submodules (SM). The DC side of an SM contains a battery pack configured with $N_{s,cells}$ series and $N_{p,cells}$ parallel cells. The submodules can be broadly classified into half-bridge (HB) and full-bridge (FB) SMs. Several research articles evaluate different modulation schemes for multi-level inverters in traction applications. However, these articles do not investigate the nearest modulation (NLC) for BI-MMCs and specifically the impact of the modulation schemes on the DC—side or battery currents.

Aim:

The aim of the master thesis is to investigate the impact of the NLC in BI-MMCs and investigate the DC—side or battery current harmonics. The thesis includes the development of a mathematical model of NLC. the thesis also includes a hardware implementation of NLC in the battery lab.

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