

Abstract

Ibrahim Ab Abdelsalam

New Efficient Submodule for a Modular Multilevel Converter in Multiterminal HVDC Networks

In high-voltage applications, the magnitude of total semiconductor losses (on-state and switching) determines the viability of modular type multilevel converters. Therefore, this paper presents a new cell arrangement that aims to lower total semiconductor loss of the modular multilevel converter (MMC) to less than that of the half-bridge modular multilevel converter (HB-MMC). Additional attributes of the proposed cell are: it eliminates the protective thyristors used in conventional half-bridge cells that deviate part of the dc fault current away from the anti-parallel diode of the main switch when the converter is blocked during a dc short circuit fault and it can facilitate continued operation of the MMC during cell failures without the need for a mechanical bypass switch. Thus the MMC that uses the proposed cell retains all advantages of the HB-MMC such as full modularity of the power circuit and internal fault management. The claimed attributes of the proposed cell are verified using illustrative simulations and reduced scale experimentations. Additionally, this paper provides brief and critical discussions that highlight the attributes and limitations of popular MMC control methods and different MMC cells structures proposed in the literature, considering the power electronic system perspective.