

New Fast DC Fault Blocking Hybrid Thyristor-based Multilevel Converter for Offshore Networks

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The emergence of the Modular Multilevel Converter (MMC) has significantly altered the attractiveness of high-voltage direct current (HVDC) systems. However, the conventional MMC, employing half bridge submodules (HB-SMs), lacks the ability to withstand DC faults unless integrated with full bridge submodules (FB-SMs), resulting in escalated converter costs and losses. This paper introduces a fast DC fault blocking hybrid thyristor-based multilevel converter (F-HTMC), featuring bidirectional thyristors in series with a majority of HB-SMs and a minority of FB-SMs to achieve low conduction loss. Moreover, this converter incorporates bidirectional thyristor branches connected in parallel with the upper SMs to swiftly circulate the AC component of the fault current, enabling rapid isolation of DC faults. Additionally, the implementation of a 60-degree overlap period in each leg ensures a continuous path for the DC current to flow at any given moment, facilitating smooth DC current. The claims made are validated through MATLAB Simulink modelling of a 401-level HVDC system.