Title: Fast optimum-predictive control and capacitor voltage balancing strategy for bipolar back-to-back NPC converters in high-voltage direct current transmission systems

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Abstract: Multilevel power converters have been introduced as the solution for high-power high-voltage switching applications where they have well-known advantages. Recently, full back-to-back connected multilevel neutral point diode clamped converters (NPC converter) have been used inhigh-voltage direct current (HVDC) transmission systems. Bipolar-connected back-to-back NPC converters have advantages in long-distance HVDCtransmission systems over the full back-to-back connection, but greater difficulty to balance the dc capacitor voltage divider on both sending and receiving end NPC converters. This study shows that power flow control and dc capacitor voltage balancing are feasible using fast optimum-predictive-based controllers in HVDC systems using bipolar back-to-back-connected five-level NPC multilevel converters. For both converter sides, the control strategytakes in account active and reactive power, which establishes ac grid currents in both ends, and guarantees the balancing of dc bus capacitor voltages inboth NPC converters. Additionally, the semiconductor switching frequency is minimised to reduce switching losses. The performance and robustness of the new fast predictive control strategy, and its capability to solve the DC capacitor voltage balancing problem of bipolar-connected back-to-back NPCconverters are evaluated.

Author Keywords: Multilevel Converter; Inverter; Limits

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