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Fuzzy Logic Controller Design for Circulating Current Control in Three-Phase Modular Multilevel Converter Fed by Fuel Cell

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Abstract: *The Modular-Multilevel Converter (M-MC) has substantially contributed to the integration of non-conventional energy sources into grid systems, particularly Proton Exchange Membrane Fuel Cells (PEMFC). This paper proposes an M-MC system to interface PEMFC with the grid, focusing on controlling circulating currents and ensuring stability. A Fuzzy Logic is employed to mitigate circulating current (CC) harmonics. Phase-Shifted Carrier (PSC) modulation is used to improve capacitor voltage balancing, thus maintaining a constant input voltage. The boost converter enhances the input voltage to a higher level, which is essential for maintaining the necessary voltage margin in MMC. The main contribution of this paper is (I)The PSC-PWM was implemented for MMC to maintain a quality +y of output voltage by the control of capacitor voltages.(II)The proposed fuzzy logic controlled circulating current must be achieved in order to regulate the dc ripple component, arm current, and circulating current of MMC.(III)It is essential to regulate the SM capacitor voltages in order to provide a balanced and equal output while maintaining the ratings and limits of the SMs, and this will be accomplished.*

Keywords: Modular Multi-level Converter (MMC), Sub-modules (SM), Fuzzy Logic Control (FLC), Proton Exchange Membrane Fuel Cell (PEMFC), Phase with modulation (PWM), Phase Shift Carrier (PSC), Circulating Current (CC).

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