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Performance of Interconnection and Damping Assignment Passivity-Based Controller on Inverter Circuits

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ABSTRACT

This paper presents an extension work on the application of interconnection and damping assignment passivity-based controller (IDA-PBC) from the conventional H-bridge inverter to a 5-level Cascaded H-bridge Multilevel Inverter (CHMI). With the controller, the inductor current and the voltage capacitor track the desired reference of the inverter to ensure that the output voltage maintains its regulation while the Total Harmonic Distortion (THD) is kept at low levels with fast transient response. It is designed based on the Port-Control Hamiltonian theory exploiting the dissipation properties of the averaged model of inverter circuits. The results obtained have proven that the IDA-PBC previously developed for the H-bridge inverter can be easily extended and applied to the CHMI circuit. The simulation results showed that the IDA-PBC is able to maintain the output voltage regulation in both circuits in the case of no-load to full-load condition, load uncertainty, and structural uncertainty while maintaining THD of less than 5%. However, in all cases, CHMI has shown better performance in terms of THD percentage and transient response compared to the H-bridge inverter, which are 290 μs and 150 μs respectively.

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