Integration of Energy Storage with Cascaded H-bridge Multilevel Inverters

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Abstract

Multilevel converters are mainly utilized to synthesize a desired single- or three-phase voltage waveform. The desired output voltage is obtained by combining several separate dc voltage sources. Solar cells, fuel cells, batteries, and ultracapacitors are the most common independent sources used. Multilevel converters have found wide applications in motor drives, static VAR compensators, and uninterruptible power supplies. Their main advantages are low harmonic distortion of the generated output voltage, low electromagnetic emissions, high efficiency, capability to operate at high voltages, and modularity. In general, multilevel converters are categorized into diode-clamped, flying capacitor, and cascaded H-bridge.

In early implementations, each H-bridge cell was supplied by an independent dc source. In my work, only one cell needs to be supplied by a real dc power source and the remaining cells could be supplied with capacitors. However, studies show that voltage regulation of capacitors is not an easy task. Two control methods called phase-shift modulation and sigma delta modulation are used to improve the capacitor voltage regulation. The simulation results agree with the analysis and show that the regulation of the capacitor voltage is achievable without deteriorating the total harmonic distortion.

Biography

Jingsheng Liao obtained his MS degree in Electrical Engineering from Huazhong University of Science and Technology, China in 2003. During this period, he worked on Rogowski coil current transformer. He is now a Ph.D. candidate in the Department of Electrical Engineering at Missouri University of Science and Technology. His current research interests include modeling, analysis, design, and control of power electronic converters especially multilevel converters, power electronics and motor drives and hybrid electric vehicles.