

1. Real-Time Simulation Model and Experimental Test Bench for Modular Multilevel Converter

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Abstract: Real-time simulation platform of modular multilevel converter (MMC) can be used for the development and testing of control and protection systems. The large number of submodules (SMs) introduces great challenges for real-time simulation and controller implementation. This paper presents i) an equivalent real-time simulation model of the half-bridge submodule (HBSM) based MMC, ii) two kinds of field programmable gate array (FPGA) implementation of the MMC model, and iii) a multi-core digital signal processor based MMC controller. The circuit in SM is described by mathematical equations, and implemented in FPGA with either the sorting network or Aurora interface. Using the multi-core architecture, the calculation efficiency of the MMC controller is improved by dividing the control task into different cores. Based on the model and controller, an experimental test bench is established, and various cases are tested in a 20-level MMC-HVDC study system. The results verify the accuracy of the model by comparing with those from PSCAD/EMTDC and demonstrate the performance of the controller. © 2018 IEEE.

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