

PSO Tuning PI Controller for Multilevel Inverter Output Voltage Regulation

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Abstract

In recent decades, renewable energy production has been an underlying trend in the energy sector. Multilevel inverter has been used especially in renewable energy aspects in order to assess Total Harmonics Distortion (THD). Multilevel inverters have shown superior performance in terms of reducing harmonic disturbances, torque pulsations, and voltage stress through switching devices. Conventionally, PI controller are preferable to be applied in multilevel inverter due to its simplicity. However, it has a limitation of optimization when it comes to increase of loads under working condition. This paper focuses on developing a Particle Swarm Optimization (PSO) algorithm for optimal tuning of PI controller for Cascaded H-Bridge Multilevel Inverter (CHMI) in order to regulate a smooth output voltage of the system. PSO controller is implemented to produce an optimum regulated output voltage using MATLAB/Simulink. The system will go under three load variation conditions. The PSO-PI controller have been applied to a 7-level CHMI that uses 12 IGBTs with 20kHz switching frequency and 0.9 modulation index with 0.4 μ s of sample time. As compared PSO-PI to conventional PI controller during nominal load, 20 % reduction in THD is observed. In addition, voltage drop and transient time during no load to full load shows an improvement after applying PSO-PI. During load variation was halved and varied at certain point, PSO-PI also exhibit improvement in transient time and reduction in THD is observed compared to conventional PI controller.

Keywords: Multilevel inverter; Particle swarm optimization; Voltage regulation.