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Improving Power Quality and Dynamic Performance of Modular Multilevel Converter based Microgrid Solar System using Intelligent MPPT controller

Yakhelef Yassine
Laboratory of Automation and
Informatics-Guelma, LAIG
University of Boumerdes, 35000, Algeria

Herkat Wiam
Laboratory of Signals and Systems, LSS
University of Boumerdes, 35000, Algeria

Abstract

while it provides perfectly clean electricity without any environmental effect, solar energy is the most abundant and free renewable energy source worldwide. However, because of its highly dependency on the weather condition variation particularly those of operating temperature and sunlight irradiance, the solar based electrical energy conversion system is characterized with lot of energy wastage and noticeable low efficiency, which requires an appropriate and effective design of its control part and components for enhancing its generation and delivery performance. The purpose in this work is to perform an investigate study and simulation under Matlab/Simulink environment of the behaviour and reaction of the artificial neural network (ANN) based MPPT controller under various and different climatic condition characterized particularly by the rate of the sunlight intensity variation during the day. Different weather situations regarding the sunlight intensity rate variation ranging from slow to harsh and severe changes are considered and applied in order to study the dynamic performance of the MPPT controller for improving the power quality generation as well as the dynamic performance of the grid tied solar conversion system when implemented around the modular multilevel converter as the newly power conversion emerged technology whatever these atmospheric situations. The simulation results have shown the superiority and outstanding of the ANN MPPT controller in terms of the output power quality and dynamic performance in reaching and retaining the stability at the higher power level regardless of the weather change.

Keywords

Microgrid solar system - Modular Multilevel Converter (MMC) - ANN - MPPT controller - Power quality - Dynamic performance.