Modeling and Control of Grid-Connected Photovoltaic Power Plant With Fault Ride-Through Capability

Ali Q. Al-Shetwi[1]
Faculty of Electrical and Electronic Engineering,
University Malaysia Pahang (UMP),
Pekan 26600, Pahang, Malaysia
e-mail: alialshetwi@yahoo.com

Muhamad Zahim Sujod
Faculty of Electrical and Electronic Engineering,
University Malaysia Pahang (UMP),
Pekan 26600, Pahang, Malaysia
e-mail: zahim@ump.edu.my

According to modern grid codes (GCs), high penetration of photovoltaic power plants (PVPPs) to the utility grid requires a reliable PV generation system by achieving fault ride-through (FRT) requirements. In order to meet these requirements, there are two major issues that should be addressed to keep the inverter connected during grid fault. The two issues are the ac over-current and dc-link over-voltage that may cause disconnection or damage to the grid inverter. In this paper, the control of single-stage PVPP inverters is developed to address these issues and enhance FRT capability. The proposed control scheme introduces the dc brake chopper circuit and current limiter to protect the inverter and ride through the fault smoothly with no perceptible overcompensation. A 1.5 MW PVPP connected into the Malaysian grid and modeled in SIMULINK is utilized to explain the proposed control scheme. The simulation results presented demonstrate the effectiveness of the overall proposed control strategy to ride through different types of faults and to help to ensure the safety of the system equipment.
[DOI: 10.1115/1.4038591]

Keywords: photovoltaic system, fault ride-through, distribution generation, power system faults, dc-chopper circuit