Modeling and Dynamics Study of Large Scale PV System Connected Malaysian Grid under Different Fault Conditions

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

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

***Abstract*— The installation of photovoltaic power plants and integration with electric grid has become more widespread. As there is a significant increase in the size and capacity of grid-connected power plants, the stability and reliability of the grid become more important. A 1.5 MW PV station connected to the distribution side of the Malaysian grid via a voltage source inverter is modeled and simulated using Matlab/Simulink. This study presents the modeling of PV module behavior and characteristics based on the mathematical model equivalent circuit. The Simulink was run to simulate PV array sizing depending on perturb and observed maximum power point technique to enhance the efficiency of modules, and obtain maximum available power using variable perturbation step size dependent on power changes. The simulation result was matched to the results of sizing calculation. The inverter control system modeling and park transformation were carried out. Phase locked loop was used to track the grid frequency and voltage. The Malaysian grid-connected PV system is designed and modeled according to the regulations and guidelines of Tenaga Nasional Berhad concerning grid-integration of PV power generation system to LV and MV networks. Finally, this paper analyzes the dynamic response of the proposed PV plant under various types of symmetrical and non-symmetrical grid faults. The results indicated that the short circuit faults in the distribution grid side had disturbing effects on the optimal operation performance of PV systems. Whereas, the influence of grid faults depends on the fault type. In addition to that, the simulation result proved that the symmetrical fault has higher impact on PV system operation than non-symmetrical faults.**

Keywords*— — Fault analysis; PV system modeling; Grid-connected inverter; Malaysian grid; Distribution system.

978-1-5090-2889-4/16/$31.00 ©2016 IEEE