Adaptive controller design and sizing of battery energy storage system for enhancement of stability of an Islanded Solar photovoltaic systems

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In this era where the world is faced with many challenges related to clean energy, Solar Photovoltaics SPV) system provide alternative source of energy which is cheaper and readily available. However, the intermittency nature of the solar power affects the voltage and frequency stability of the SPV system. To account for the effect, Energy Storage System (ESS) can be used under suitable control mechanism to stabilize the SPV system. Among different types of ESS, Battery Energy Storage System (Bess) offers a rapid response and therefore, suitable for voltage and frequency stability studies in this dissertation, an islanded SPV system was investigated, the BESS was sized based on compensation of the Direct Current (DC) link voltage and a Sinusoidal Pulse Width Modulation (SPWM) adaptive controller was designed under Voltage Frequency (VF) control strategy. Hill Climbing Maximum Power Point Tracking (HC-MPPPT) algorithm with boost converter was used to track the Maximum Power Point (MPP) of the SPV system. The H-bridge Single phase inventor was used for DC-AC conversion, while a Buck-Boost converter was implemented for charging and discharging the BESS. The system was modeled in MATLAB/ Simulink environment and voltage and frequency stability studies were performed. Under VF control strategy with the SPWM adaptive controller, the abrupt changes in solar insolation and variations of the load. The SPWM adaptive controller showed fast response with capability to maintain the voltage and frequency with the standard desired values compared to the conventional Pulse Width Modulation (PWM) controller.