Operational Characteristics of Hybrid-Powered Three-Phase Induction Motor via Synchronous and PV Generators with MPPT Utilised by Synchronous Generator Automatic Voltage Regulator

M. S. Widyan

Abstract
The operational characteristics of a stand-alone hybrid-powered system are investigated. The sources are conventionally powered synchronous generator and photovoltaic (PV) array. The voltage of the common coupling point is controlled by the automatic voltage regulator of the synchronous generator via which the maximum power point (MPP) of the PV generator is tracked using the open-circuit voltage method. Numerical simulations based on the non-linear dynamical model in $dq$ stationary reference frame are conducted. Power control unit is incorporated to control the driving torque of the synchronous generator once the PV generator becomes unable to meet the requirements of the motor because of reduction of the solar irradiance and/or increase of the load. The analysis includes the response of the system after step changes in the load coupled to the motor and after step changes in the levels of the solar irradiance. The steady-state characteristics of the induction motor in case of hybridisation at various solar intensities are presented and compared with the case when the motor is powered by fixed terminal voltage. It is concluded that the proposed system can run at wide range of operating conditions and robust enough to withstand system parameters step changes.