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Modeling and parameter estimation of solar photovoltaic based MPPT control using EKF to maximize efficiency

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Abstract : In this paper, we focus on the design, modeling and implementation of a MPPT controller based maximum power tracking of photovoltaic system. The electrical characteristic of The PV system is non-linear and changes with the solar irradiation and the ambient temperature. Therefore, the incremental conductance (IC) method control is known for its stability and robustness, and is used to extract the maximum energy from the PV source using a boost converter topology. It provides a strong basis for the improvement and optimization of control parameters of a photovoltaic system. Implementing MPPT algorithm usually need the use of a lot of sensors if accuracy of the system has to be increased. However, IC method with an extended Kalman filter (EKF) can be utilized in order to estimate some parameters to reduce the number of Sensors. The EKF is deployed in the optimal position to estimate both current and the capacitor voltage, thus allowing to eliminate two sensors devise from the entire PV system, which increases the system efficiency and reliability, simplifies the control method and decreases the system cost. The performance of the proposed technique is validated by experimental and simulation results under different operating conditions and load changes.

Key words : Efficiency; EKF; Incremental conductance; MPPT; Photovoltaic; Sensor less control

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