An Accurate, Low-cost Photovoltaic (PV) Evaluation-on-Chip (EoC) System by Combining MATLAB/Simulink and Microprocessor

Le Phuong Truong, Tsai Huan-Liang
E-mail: michael@mail.dyu.edu.tw

ABSTRACT

This paper proposes a low-cost photovoltaic (PV) evaluation-on-chip (EoC) system with a configuration by combining both MATLAB/Simulink software and the microprocessor. The high accurate data acquisition (DAQ) with a 12-bit analog-to-digital conversion (ADC) resolution to measure irradiance, as well as the cell temperature, voltage, and current of PV devices are acquired through the device based on STM32F407VET6 microcontroller (MCU). Solar irradiance, as well as the cell temperature, operating voltage, and output current of PV devices are acquired through the proposed device integrating a MCU of STM32F407VET6 and a high-accuracy data logger with a 12-bit ADC resolution. These data are displayed and input to a PV model embedded in MCU for simulation that is called PV EoC system. Thus, one can compare the simulation results of PV model with those obtained by the direct measurement of PV modules under real working conditions and the difference information can be displayed in LCD and/or MATLAB/Simulink. The proposed PV EoC system has been demonstrated to have both accuracy and confidence. From the practical viewpoint of PV system engineering, the low-cost portable PV EoC system has the advantages of evaluating and monitoring functions at the same platform, easy-to-use DAQ and simulation, sufficient precision, and compactness as compared the well-developed ones.

Keywords: PV evaluation-on-chip (EoC) system, STM32F407VET6 MCU, MATLAB/Simulink

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