

ABSTRACT

PROTOTYPE SOLAR CELLS EMULATOR DESIGN USING BUCK CONVERTER BASED ARDUINO

By

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Attempting improve the solar cell system in terms of reliability and efficiency is being continued. The research requires a continuity that is not obstructed by environmental conditions such irradiance and temperature or the other factors. The research needs a device to replace the solar cells which is not affected by these factors, but still has the same output and characteristics. The device which is purposed in this thesis is solar cell emulator based on buck converter.

Solar cells emulator is a controlled converter circuit so it has current, voltage and power output which are the same as the characteristics of the real solar cell module. Current and voltage values are obtained from controlling current of buck converter. Reference current which is used, is the current is generated by modeling solar cells using mathematical equations solar cells on the Arduino microcontroller.

This thesis use Shell SP75 module as a reference module. In standard testing conditions (25 °C and 1000 W/m²), the result of comparison at maximum power point of simulation and solar cell emulator hardware with a reference module has a small average error, in the hardware testing that are 0.707% for power value, 3.636% for current value and 2.353% for voltage value, while the simulation testing are 0.344% for power value, 0.136% for current value and 0.224% for voltage value. The characteristics obtained from the simulation and testing hardware solar cells emulators at various irradiance and cell temperature values, that was decreased in irradiance values that leaded short circuit current, open circuit voltage and maximum power which was generated was decreased, while the increased in the cell temperature value that leaded decreased open circuit voltage and maximum power, but the short circuit current does not increased significantly.

Keywords: Solar Cells Emulator, Buck Converter, Irradiance, Temperature.