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Comprehensive Analysis of a Solar Measuring System and Response of Various Photovoltaic Modules and Systems

Presented in this paper is the determination of photovoltaic (PV) module parameters for various PV technologies and their response at different operating conditions. A xenon arc lamp solar simulator characterized at the Fort Hare Institute of Technology (FHIT) was used to simulate the desired irradiance setpoints. The solar simulator was characterized in terms of its spectral match, spatial uniformity and temporal instability was carried out over a 110 cm x 129.5 cm target area, since this represents that maximum area required as dictated by the available modules. The spectral match across all wavelength intervals between 0.3 – 1.14 µm was between 0.75 – 1.25 and corresponds to class A. A spatial uniformity of 3.26% was obtained which matches a class A, and finally, a temporal instability of 3.93% obtained conformed to class B. The solar simulator's irradiance setpoint and cell surface temperature was monitored and measured via a supervisory control and data acquisition (SCADA) tool on a personal computer. Furthermore, the photovoltaic module parameters such as current, voltage, and maximum power was measured by employing a semiconductor characterization machine was compared with data provided by the PV module manufacturers at standard test conditions (STC).

Apply to be
 considered for a student
   award (Yes / No)?

Yes

Level for award
 (Hons, MSc,
   PhD, N/A)?

MSc

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