Development of photovoltaic cell models using fundamental modeling approaches

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Abstract: In this paper, three advanced modelling approaches will be performed to well describe the actual behavior of photovoltaic (PV) cells, in which some total solar irradiance changes are considered. The first one uses a specific solar cell provided by the Sim-Electronics tool of the Matlab software. It is used to simulate the actual behavior of PV cells instead of the conventional electrical circuit based on either single or double diodes. The second approach adopts some physical components provided by the Simscape library to reach the same above mentioned goal. The third approach uses the Simulink blocks to build the mathematical equations describing the PV cell behavior, in which some mathematical operators and functions are used. The three proposed models have the ability to predict the actual behavior of PV cells under different weather conditions. This can improve the extraction of the maximum power and contribute even to the synthesis of the appropriate controller. The performances assessment of each proposed model is established in term of the provided output power as well as the generated current and voltage.

Keywords : PV cell, Simulink, Simscape, Simelectronics, PV mode