Analysis of Impedance Matching Technique for Novel Supercapacitor Assisted PV Systems

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***Abstract*—To extract the maximum power from a photovoltaic (PV) system, the maximum power point (MPP) of the PV array must be tracked continuously. A directly coupled load with the PV array does not track the MPP of the PV array because the load has a constant resistive value. Therefore, to track the MPP of the PV array, a technique called impedance matching is used. This is done by continuously matching the load impedance to the instantaneous impedance of the PV array. Switch mode DC-DC converters are widely used for this purpose which also helps to interface the DC output of the PV array with power distribution systems in order to deliver the power to the consumer end. However, the efficiency of these converters lies around 90% which degrade the end to end efficiency of the PV system. In this context, novel supercapacitor (SC) assisted PV systems have been introduced, which were able to enhance the end to end efficiency of PV systems. However, existing impedance matching technique is no longer valid for SC assisted PV systems. Therefore, still it is a challenge for these systems to track MPP of the PV array continuously while in operation. This paper presents a study on impedance matching technique for the novel SC assisted PV systems. Previously, it has been experimentally shown that a series connected SC bank between PV array and DC-DC buck converter of a PV system could deliver higher end to end efficiency than typical systems. This study validates the impedance matching technique for SC assisted PV systems by connecting a SC bank in series with buck, boost, and buck-boost converters. Simulation results indicate that this can be achieved by carefully designing the system with given parameters.**

Keywords—DC-DC converter, Impedance matching, PV system, Supercapacitor