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Design, Analysis, and Implementation of Solar Power Optimizer for DC Distribution System

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This paper proposes a high step-up solar power optimizer (SPO) that efficiently harvests maximum energy from a photovoltaic (PV) panel then outputs energy to a dc-microgrid. Its structure integrates coupled inductor and switched capacitor technologies to realize high step-up voltage gain. The leakage inductance energy of the coupled inductor can be recycled to reduce voltage stress and power losses. A low voltage rating and low-conduction resistance switch improves system efficiency by employing the incremental conductance method for the maximum power point tracking (MPPT) algorithm. Because of its high tracking accuracy, the method is widely used in the energy harvesting of PV systems. laboratory prototypes of the proposed SPO that have an input voltage range of 20 to 40 V and a maximum PV output power of 400 V/300 W are applied. The highest PV power conversion efficiency is 96.7%. The maximum MPPT accuracy is 99.9%, and the full load average MPPT accuracy is 97.8%.