An Efficient PV Power Optimizer With Reduced EMI Effects: Map-Based Analysis and Design Technique

Somnath Maity and Madisa V G Varaprasad

Department of Electrical Engineering, NIT Rourkela

The aim of this paper is to develop a one-dimensional (1-D) discrete-time model or map that will ensure reliable and safe chaotic operation of a modular photovoltaic (PV) power optimizer (PO) system. Based on this 1-D map, we perform the detailed bifurcation analysis and discuss a preliminary design guideline to operate the system into a desired chaotic regime, i.e., just after the golden mean. We show that operating POs in chaotic regime can not only yield broader power spectrum with reduced spectral peak at the switching frequency harmonics of the system, but also exhibits faster tracking responses with overall conversion efficiency $\eta \leq 98\%$. Moreover, this optimized frequency-domain as well as time-domain performance are numerically analyzed and then verified experimentally using a prototype modular boost-type PV system.

More in: IEEE Transactions on Energy Conversion, DOI: 10.1109/TEC.2017.2767629