

High Dynamic Performance Nonlinear Source Emulator - DTU Orbit (08/11/2017)

High Dynamic Performance Nonlinear Source Emulator

As research and development of renewable and clean energy based systems is advancing rapidly, the nonlinear source emulator (NSE) is becoming very essential for testing of maximum power point trackers or downstream converters. Renewable and clean energy sources play important roles in both terrestrial and nonterrestrial applications. However, most existing NSEs have only been concerned with simulating energy sources in terrestrial applications, which may not be fast enough for testing of nonterrestrial applications. In this paper, a high-bandwidth NSE is developed that is able to simulate the behaviors of a typical nonlinear source under different critical conditions that can happen during their operations. The proposed 200-W NSE, which consists of a fourth-order output filter buck converter and a novel nonlinear small-signal reference generator, can quickly react not only to an instantaneous change in the input source but also to a load step between nominal and open circuit. Moreover, all of these operation modes have a very fast settling time of only 10 μ s, which is hundreds of times faster than that of existing works. This attribute allows for higher speed and a more efficient maximum power point tracking algorithm. The proposed NSE, therefore, offers a superior dynamic performance among devices of the same kind.

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