

Development of Power Quality Controller to Be Connected in Parallel to Dispersed Power Sources

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Abstract

The number of installations of dispersed power sources is expected to increase, as they can be constructed quickly near loads. Many dispersed power generators, such as fuel cell systems and photovoltaic generation systems, produce direct-current electricity, and thus require an AC-to-DC converter (inverter) to connect to an alternating-current grid system. Unfortunately, as AC-to-DC converters generate higher harmonics, connecting them to AC grid systems can lead to degradation of system power quality. Additionally, the power output of dispersed power generators such as photovoltaic generation systems and wind power generators fluctuates, making AC system interconnection problematic.

To solve these problems, we have developed a power quality controller (PQC) with built-in electric double-layer capacitors. Our PQC is able to supply active power quickly, minimizing output power fluctuations in dispersed power sources. Furthermore, its active filter function can be used to suppress the low-order harmonics generated by dispersed power sources.

In this paper, we explain the principle and operation of the active filter function of the PQC, and the control method for smoothing power fluctuations. We also describe the results of an operation verification test we conducted using a 7-kVA prototype in a simulated transmission. The test results show that our PQC reduced 5th and 7th harmonics at the source by more than half, and held system voltage fluctuations to under 8% even in large power changes.