A SINGLE-PHASE POWER SERIES COMPENSATOR FOR VOLTAGE DISTORTION

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ABSTRACT

The purpose of this paper is to describe the work that is being done in the design and implementation of a single-phase series power compensator for electrical power quality purposes. This system is able to compensate several voltage related problems in the power grid, namely: voltage distortion due to harmonics, voltage flicker (sub harmonics) and over or under voltages. The power circuit of the series compensator is described in this paper, and some experimental results are presented.

Voltage distortion is caused by several factors. Nearby non linear loads and some types of voltage sources (renewable energy sources, for example), are very common causes. Power quality problems origin instantaneous and long term effects on electrical equipment. The short term effects are malfunctioning, interferences and degradation of the performance of devices or equipments. Effects in the long run are, basically, overheating and premature aging of the electric devices.

Active power filters have several advantages over passive ones: compensation is automatic, there is no risk of resonances, unity power factor (or any other value) can be achieved permanently and without disturbing the electrical network, they can compensate for phase unbalance in three-phase electrical systems. They can also be combined with passive filters (which may be already installed) in hybrid topologies, in order to diminish their rated power.

The system's power compensator is constituted by an IGBT single-phase full-bridge inverter, with an inductive and capacitive filter on the output. This passive filter feeds an isolation transformer which adds the compensating voltage to the mains voltage, providing an ideally non-distorted voltage to the linear load. The existence of snubber circuits associated to each IGBT is essential, because the inverter load is highly inductive, causing very high voltage glitches in the semiconductors when they turn off.

The control system of this series compensator is implemented on a personal computer (PC) with a general purpose multifunction data acquisition board included in the PCI bus. The major advantages of this approach are the relative low cost of the equipment, the high processing capabilities of the personal computer processor, and its versatility. The personal computer used has a *733MHz Intel Pentium III* processor with *512MByte* memory. The data acquisition board is the model *PCI-MIO-16E*-4 manufactured by *National Instruments*.

The proposed single phase series compensator for voltage distortion reduces effectively the voltage total harmonic distortion, providing better power quality than it is available on the mains. Within certain limits, it is also capable of correcting fundamental voltage amplitude.

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