A full compensating system for general loads, based on a combination of thyristor binary compensator, and a PWM-IGBT active power filter

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Abstract

A full compensating system for distribution networks, able to eliminate harmonics, correct unbalanced loads, and generate or absorb reactive power, is presented. The system is based on a combination of a thyristor binary compensator (TBC), and a pulsewidth-modulation insulated gate bipolar transistor active power filter (APF) connected in cascade. The TBC compensates the fundamental reactive power and balances the load connected to the system. The APF eliminates the harmonics and compensates the small amounts of load unbalances or power factor that the TBC cannot eliminate due to its binary condition. The TBC is based on a chain of binary-scaled capacitors and one inductor per phase. This topology allows, with an adequate number of capacitors, a soft variation of reactive power compensation and a negligible generation of harmonics. The capacitors are switched on when the line voltage reaches its peak value, avoiding inrush currents generation. The inductor helps to balance the load, and absorbs reactive power when required. The APF works measuring the source currents, forcing them to be sinusoidal. The two converters (TBC and APF) work independently, making the control of the system simpler and more reliable. Simulations show that the system is able to respond to many kinds of transient perturbations in no more than a couple of cycles. The paper analyzes the circuit proposed, the way it works and shows some experimental results obtained under operation.

Keywords

Pulse width modulation, Thyristors, Active filters, Reactive power, Power system harmonics, Power harmonic filters, Capacitors, Power generation, Inductors, Insulated gate bipolar transistors.