Shunt Active Power Filter with Improved Dynamic Performance

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Harmonic compensation circuit with current-fed active power filter without feedback (with unity gain)

Tests circuit of classical three-phase shunt active power filter

Experimental waveforms of classical active power filter in steady-state with the resistive load

Discussion about possible solutions

For predictable loads:
1. Classical APF with non-causal control algorithm
2. Classical APF with passive control algorithms

For unpredictable loads:
1. Causal APF
2. Set of APFs

The APF output inverter current ripple calculation

The circuit marked consists of the main inductor Ls, the output filter capacitor C and the series resistance Rs.

\[
I_d = I_{dc} \left( 1 + \frac{1}{\pi f L} \right)
\]

where:
- \( I_d \) is the output current ripple
- \( I_{dc} \) is the output current
- \( f \) is the switching frequency
- \( L \) is the output filter inductance

Simulation waveforms of single-phase active power filter with modified output inverter in steady-state with the resistive load

Simulation waveforms of single-phase active power filter with classical output inverter in steady-state with the resistive load

Conclusion

The presented solution is good for noise type nonlinear loads (such as in an arc furnace), where the load currents are non periodic and stochastic. Using the proposed APF with improved dynamic performance it is possible to decrease harmonics.