Convertible Unified Power Quality Conditioner to mitigate voltage and current imperfections

ABSTRACT

This paper proposes a novel convertible unified power quality conditioner (CUPQC) by employing three voltage source converters (VSCs) which are connected to a multi-bus/multifeeder distribution system to mitigate current and voltage imperfections. The control performance of the VSCs is characterized by a minimum of six circuit open/close switches configurable in a minimum of seventeen combinations to enable the CUPQC to operate as shunt and series active power filters (APFs), unified power quality conditioner (UPQC), interline UPQC (IUPQC), multi-converter UPQC (MC-UPQC) and generalized UPQC (GUPQC). The simulation and compensation performance analysis of CUPQC are based on PSCAD/EMTDC.

SOFTWARE: MATLAB/SIMULINK

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EXPECTED SIMULATION RESULTS

Fig.2. Feeder1 (a) Load current (b) Source voltage

Fig.3. Feeder1 (a) Compensation currents (b) Compensation voltages
Fig. 4. Feeder1 (a) Source currents (b) Load voltages

Fig. 5. Feeder1 THD spectrum (a) Currents (b) Voltages

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Fig. 6. Feeder3 source voltage

Fig. 7. Feeder3 compensation voltage

Fig. 8. Feeder3 load voltages

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Fig. 9. Feeder3 voltage THD before and after compensation

Fig. 10. (a) Feeder1 source voltage (b) Feeder2 source voltage (c) Feeder3 load current

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Fig. 11. (a) Feeder 1 compensation voltages (b) Feeder 2 compensation voltages (c) Feeder 3 compensation currents

Fig. 12. (a) Feeder 1 load voltages (b) Feeder 2 load voltages (c) Feeder 3 source currents

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Fig. 13. THD before and after compensation (a) Feeder1 voltage (b) Feeder2 voltage (c) Feeder3 current

Fig. 14. RMS voltage (a) Feeder1 (b) Feeder2

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CONCLUSION

In this paper the performance of the proposed CUPQC in three modes of operation as UPQC, MC-UPQC and GUPQC on a multi-bus/multi-feeder distribution system is validated by simulation results. The operating modes of the novel power quality conditioner in 17 different modes for compensation of currents and voltage interruptions are clearly explained. As an extension to this analysis, the authors are working on a model for characterization and testing of the proposed CUPQC.

REFERENCES