Load Compensation Using STATCOM

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Large fluctuating loads such as arc furnaces, steel rolling mills and electric traction can cause serious power quality deterioration to connected customers, including phase unbalances, harmonic distortions and large variations in reactive power demand. Unbalanced load currents, with large reactive components, result in large and unsymmetric voltage fluctuations, due to the network impedances. Power quality can be restored via load compensation using fast acting electronic compensation apparatus such as the Distribution Static Synchronous Compensator (D-STATCOM). The D-STATCOM can be connected in parallel with load and made to generate currents that cancel out the unbalanced and reactive load currents, so that the load/STATCOM parallel combination presents a unity power factor to the ac network.

The purpose of this research is to use the D-STATCOM to mitigate unbalance by compensating for the negative sequence components and to also provide power factor correction. The IEEE benchmark system [1] is used for studies and the DQ synchronous frame based control strategy coupled with Sinusoidal PWM has been implemented for the D-STATCOM.

In addition, the prospect of a D-STATCOM performing active filter operation is studied. Current Reference based PWM (CRPWM) based STATCOM was used for this purpose (without hysteresis band control). By virtue of the high switching frequency of the D-STATCOM, it is possible to generate harmonic-frequency components that cancel out the harmonics which would otherwise be injected into the system. Traditional approaches use a Phase Locked Loop (PLL) for tracking the voltage phase in the control system for the DQ synchronous frame decomposition. One difference and potential advantage of this approach is that it can be implemented without a PLL. All studies are conducted using electromagnetic transients simulation on the PSCAD/EMTDC software.

REFERENCES


[2] An Instantaneous Active and Reactive Current Component Method for Active Filters, Vasco Soares, Pedro Verdelho, Member, IEEE, and Gil D. Marques, Member, IEEE

[3] Three Phase Load Balancing and Power Factor Correction Using a PWM STATCOM, Christopher Struthers

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