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Entitled

ACTIVE FILTER MODELLING TO MITIGATE HARMONICS GENERATED BY ELECTRIC VEHICLE CHARGERS

By

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Abstract

The Automotive industry is going through a rapid transformation to adopt electrified technology. A major share of the electrified vehicles is going to be in the Battery electric vehicles (BEVs) and plug in hybrids segments that need to connect to the grid to recharge the batteries. For customer convenience, the time required for fully charging the battery need to be brought down significantly. EV charging stations are getting installed that could bring down the charging time to less than 30 minutes. However this pose a unique issue to the power quality of the utility grid. During charging, the EV charging unit injects harmonics to the grid. When a large number of EVs are getting charge simultaneously, which is a likely scenario in the future, the degradation in the power quality of the grid would be significant. This thesis discuss the modelling of an active filter to reduce the Total harmonic distortion (THD) generated by electric vehicle (EV) chargers. The main objective of this thesis is to determine the percentage of harmonic current injected by the EV chargers to the power grid and to model an active filter to mitigate the harmonic distortion generated by these chargers. The active filter is modelled as bidirectional three phase pulse width modulation (PWM) rectifier. The EV in this proposed model is represented as an injected current harmonic source. Positive sequence synchronous reference frame controller (SRFC) is used to generate the reference current. The hysteresis controller is used to compare the load current and injected current, and its output is used to generate the switching pulses for Metal oxide semiconductor field effect transistor (MOSFET). The DC link voltage control is achieved by using conventional Proportional and integral controller (PI) and fuzzy logic control PI. MATLAB/Simulink simulation result shows that the proposed filter can be used to mitigate the THD of EV chargers without violating the limit set by IEEE Std. 519-1992.

Keywords: Total Harmonic Distortion, Electric vehicle, SRFC, Fuzzy PI, Hysteresis controller, MOSFET.