

141 Research on Supraharmonics Characteristics of EV Charging Facilities based on Field Measurement

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Introduction

Due to its power electronic structure, electric vehicles (EVs) would cause supraharmonics pollution, which attracted more and more academic attention. This paper discusses the structure of different types of EV charging facilities and the mechanism of supraharmonic generation, analyses existing superharmonic testing methods, and then proposes a method based on compressed sensing with SAMP. Field tests under different charging modes are carried out. The results proved the correctness of the test algorithm and the theoretical analysis.

Generation mechanism

there are different types of facilities used in the charging of EVs at the moment, and the mechanisms of supraharmonic generation are also different. harmonics characteristics are analyzed as the figure.1.

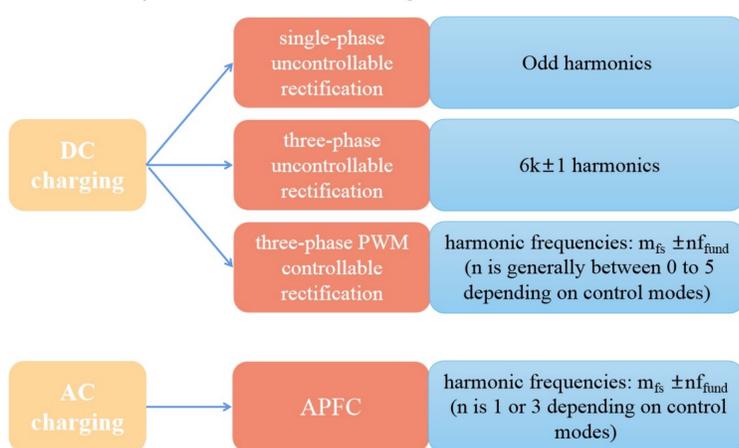


Fig.1 harmonics characteristics of different types

Measurement methods

Currently, IEC has not yet provided a standard method for measuring supraharmonics in the power grid except the informative annexes of IEC 61000-4-7 and IEC 61000-4-30, providing the measurement methods for harmonics in the frequency range of 2kHz~9kHz and 9kHz~150kHz,

but there are fundamental differences between them. Compressed sensing (CS) was introduced into the superharmonics detection, and the flow chart of the algorithm is shown in Fig.2.

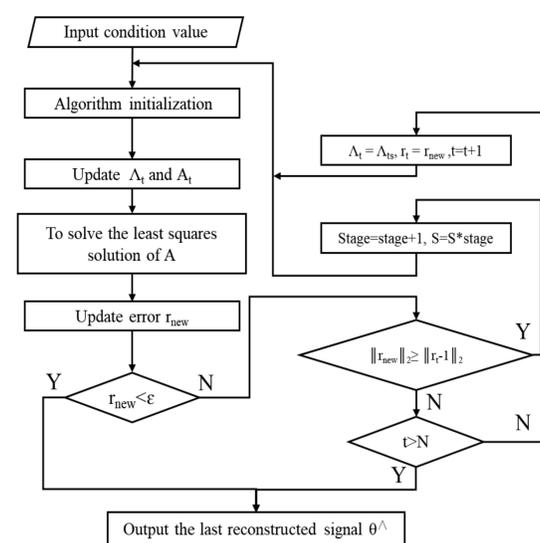


Fig.2 Flow chart of SAMP

Field Measurement

Three types of electric vehicle charging facilities are selected for testing, and the on-board chargers used in these EVs are APFC-based. EV1 is a hybrid EV with a battery capacity of 8.32kwh and a maximum charging power of 1.6kw. EV2 is also a hybrid EV, with a battery capacity of 11.1kwh and a maximum charging power of 3.2Kw. EV3 is a pure EV with a battery capacity of 32kwh and a maximum charging power of 6.6kw.

Results show that there is a significant phenomenon of supraharmonics emission when EVs are charged. The supraharmonics generated by different types of EVs can differ due to their different switching frequencies and structures. The tests also reveal that supraharmonics will produce superposition effects, and that the supraharmonics amplitude of a single EV charger based on an APFC structure is independent of the charging power.