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A steady-state harmonic controller for a series compensator with uncertain load dynamics

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Abstract— Series compensators can be used to solve a number of power quality issues in electrical distribution systems. These devices are connected in series between the point of common coupling and a load and they inject a series voltage to compensate voltage sags, swells, unbalances, and many other power quality issues. A series compensator requires a harmonic-tracking algorithm within its controller to eliminate harmonics. However, the uncertainty introduced by linear and non-linear loads connected downstream makes it difficult to guarantee closed-loop stability in every case. To overcome this problem this paper proposes a control algorithm to compensate harmonics that can be adapted in real time avoiding the need for an accurate model of the plant at the design stage. This controller is implemented in a series compensator to eliminate harmonics in two situations: filtering voltage harmonics from the grid voltage and filtering current harmonics generated by a non-linear load. The proposed algorithm was validated on a 5 kVA prototype of a series compensator.

Index Terms— Control systems; Harmonics; Power quality; AC–DC power conversion; Series active power filter; Dynamic voltage restorer

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