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# Comparative Study between Different Controllers used in Three-Phase Four-Wire Shunt Active Filter

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**Abstract**

This paper presents a simulation of Three-Phase Four-Wire Shunt Active Filter destined to suppress harmonic currents generated by nonlinear loads in low voltage networks, and also to compensate reactive power. The identification method is based on P-Q theory using Self Tuning Filters; for-leg inverter commanded by hysteresis is used as generator of harmonic compensation currents. In order to have good performances of compensation, DC voltage of the inverter must remain constant (240 V). In this paper we propose to use three different DC voltage controllers, PI, Backstepping and improved Backstepping controllers. The performances of these controllers are compared and discussed. Simulation results proved very good filtering performances with the three controllers either in transient or steady state. Improved backstepping controller gave the best results in transient state.


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*Keywords:* Shunt Active Filter (SAF), Backstepping Controller, PI Controller, Total Harmonic Distortion (THD), Self Tuning Filter (STF).

## 1. Introduction

Generally, harmonic currents are produced by the AC/DC power conversion units and the power electronic equipment. These harmonic currents are the source of adverse effects for many types of equipment such as heating in distribution transformer and perturbation of sensitive control equipment.

Many solutions have been studied in the literature to mitigate the harmonic problems, such as the passive filters which cannot completely eliminate all of the harmonic currents, and the active filters which is developed and widely used to overcome to the drawbacks of the passive filters and improve power quality [1].

As known, the performances of the active filter system depend on the performances of DC voltage controller that should maintain DC capacitor voltage of the inverter constant and follows its reference as much as possible (in

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