

International Conference on Technologies and Materials for Renewable Energy, Environment and Sustainability, TMREES15

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

A. GHAMRI^a, T. MAHNI^b, M.T BENCHOUIA^b, K. SRAIRI^a, A. GOLEA^b

^aBiskra University, Laboratory LMSE Department of Electrical Engineering

^bBiskra University, Laboratory LGEB Department of Electrical Engineering
BP. 145, 07000 Biskra, Algeria

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.

© 2015 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Peer-review under responsibility of the Euro-Mediterranean Institute for Sustainable Development (EUMISD)

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 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

* Corresponding author. Tel.: +213 776 71 31 34
E-mail address: tidj39@yahoo.fr

steady or dynamic stats). Many works dealt with DC bus controllers such as PI and intelligent controllers as in [5], [9],[10]],[11].

This paper presents a three-phase four-wire shunt active filter. We propose to use different DC control technics, PI, Backstepping and Improved Backstepping controllers. A comparison between the performances of those controllers is done. The effectiveness of the proposed Backstepping controllers is verified by computer simulation.

The studied system is composed by three-phase source that feed two balanced and identic system of nonlinear loads through the electric system. Each balanced system of nonlinear loads is composed by three loads feed by three rectifiers that generate harmonics. The three-phase four-wire Shunt Active Filter is connected as generator of compensation harmonics as mentioned in the Simulink figure below.

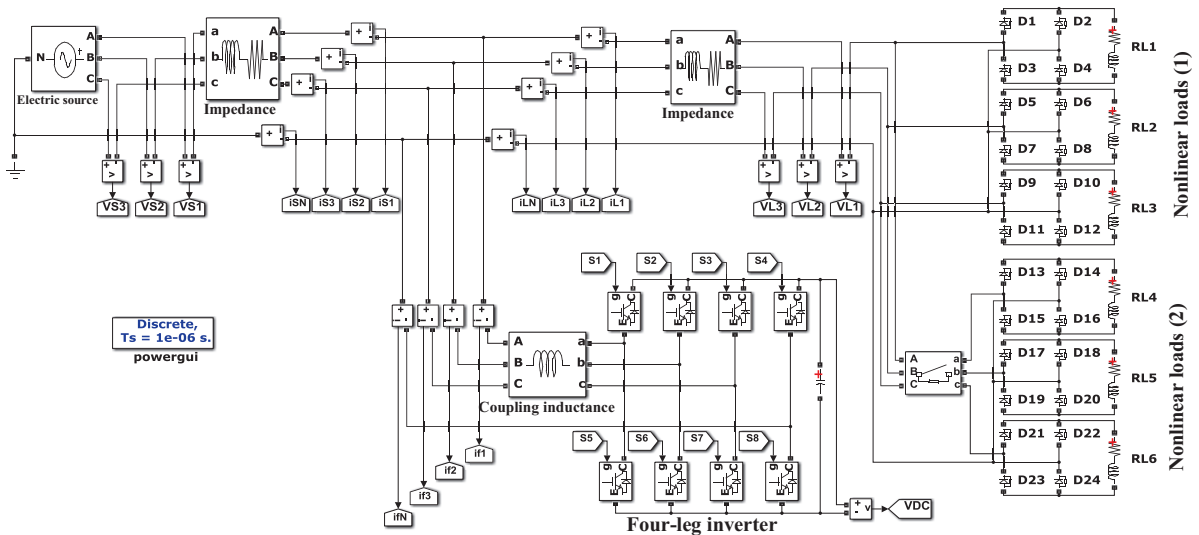


Fig. 1. System configuration.

The implanted command for the four-leg inverter is shown in Fig.2 below.

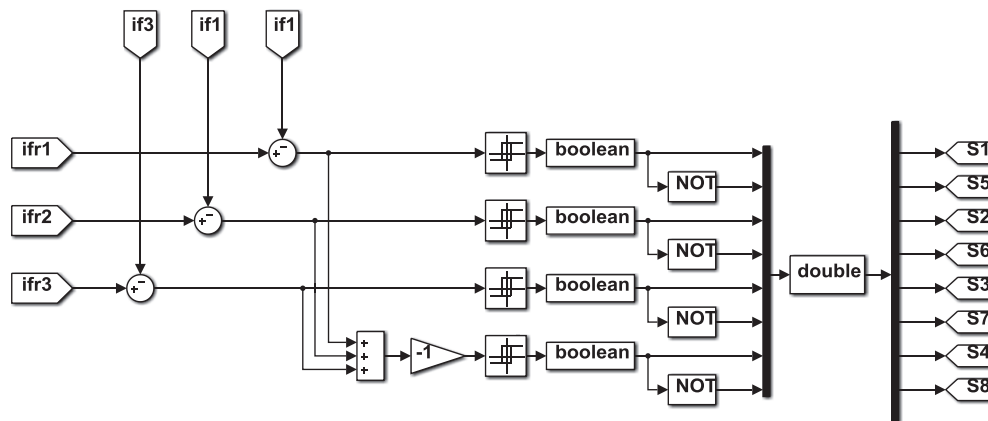


Fig. 2. Hysteresis command for the three-phase four-wire Shunt Active Filter configuration.

Download English Version:

<https://daneshyari.com/en/article/1509772>

Download Persian Version:

<https://daneshyari.com/article/1509772>

[Daneshyari.com](https://daneshyari.com)