ECHAHID HAMMA LAKHDAR UNIVERSITY - EL-OUED
Under the Supervision of the DGRSDT and in collaboration with the CRTI
International Pluridisciplinary PhD Meeting (IPPM'20)
1st Edition, February23-26, 2020
Electrical Engineering Application:Multi-phase Machines and Recent Converter

Open loop control of the inverter a structure z-source

Mohamed Tayeb Boussabeur *RABHI Boualaga

*Electric engineering department, LEVRES labs, El-Oued University, Algeria
* Electric engineering department, LMSE & LARHYSS labs, Biskra University, Algeria

E-mail : boussabeur-mtayeb@univ-eloued.dz

Abstract

In fact, improving the reliability of static converters is an important axis of research in the field of power electronics. Our work fits into this theme by introducing a new structure of DC-AC converters called z-source inverter. This structure insures the continuous magnitudes to alternatives' conversion and, eventually, increase chopper function. The particular structure of the studied converter in based on the addition of an impeding network, and it requires additional control of the VI voltage at the entrance of this bridge. By exploiting the zero state, simulation results will be presented to demonstrate the new features.

Keywords: z-source inverter, zero state, DC-AC converter, VI voltage, impeding network.

1. Introduction

The Research in this area is increasingly focused on improving the reliability and quality of electrical systems, as well as reducing their cost, in order to meet the requirements of many consumers. These systems often incorporate static converters combining power electronics, implanted in diverse fields to ensure an efficient conversion of this energy. Peng made a new topology in 2003 named z-source inverter; it is a DC/AC type. It does not only convert a continuous signal into an alternative signal, but also has the lift function that allows it to raise the voltage of the source to a higher level.[1] In this paper, there are two main methods. The first is based on controlling the VCz voltage at the Cz capacity terminals, and the second is based on controlling the Vi peak voltage. The two presented methods in this part are based on the implementation of two control loops, a current control loop crossing the network's inductor and the another loop to regulate voltage, With the aim of overcoming the overloading of the current of the inductance, as well as ensuring stability of these methods [2, 3].Under MATLAB-Simulink, the simulation results are presented and discussed to evaluate the efficiency of z source.

2. z source inverter

The source impedance converter is based on the addition of an impedance network composed of two inductors (L1etL2) and two capacitors (C1etC2), these passive elements are being connected to each other in the form of X . The impedance network ensures the connection of the converter main circuit (the switching cells) to the source or to the load or to one another converter [4, 1].

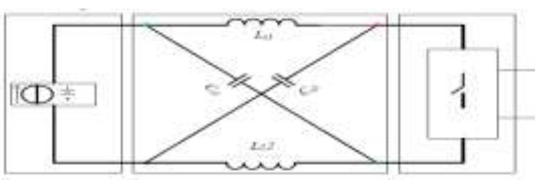

Fig.1. general structure of z-source.

3. Topology of a three-phase inverter with a z-source structure

The topology of a three-phase voltage inverter with z-source structure is given in the figure 2; This inverter consists of a main circuit, which includes the three (03) switching cells, connected to the source of continuous voltage via an impedance network and a protection diode. This latter prevents the discharge of two capacitors into the source of continuous voltage [4, 1, 5, 6].

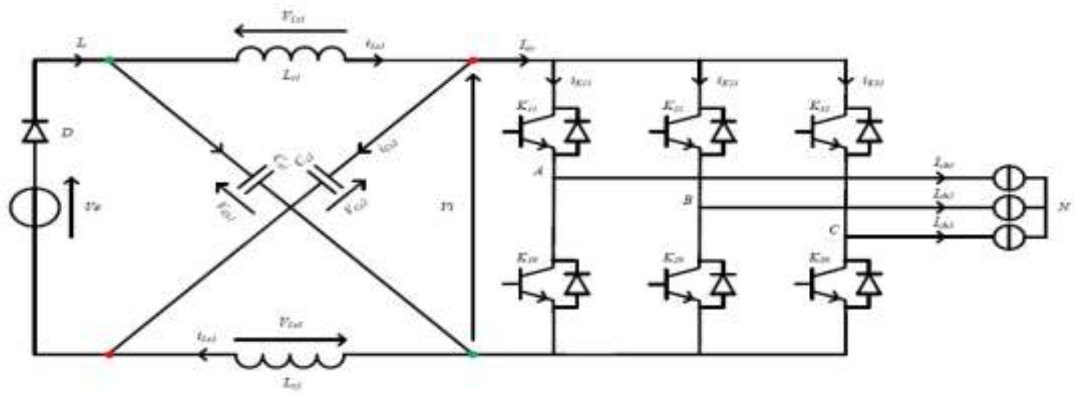

Fig.2. General structure of a z-source converter.

4. Results and Discussion

4. 1Results of the control simulation of a z-source inverter

In order to validate the two control models studied in this conference, a simulation was carried out using SBC control strategies. This simulation is based on the change in load in two moments different (0.5s, 0.65s).

4.2The values of the passive items used in this simulation are:

Ve=300V;Lf=12mH;rLf=2Ω ;Cf=300µF ;fm=5khz ;Lz=10mH;Cz=4700µf;

Rch=10Ω

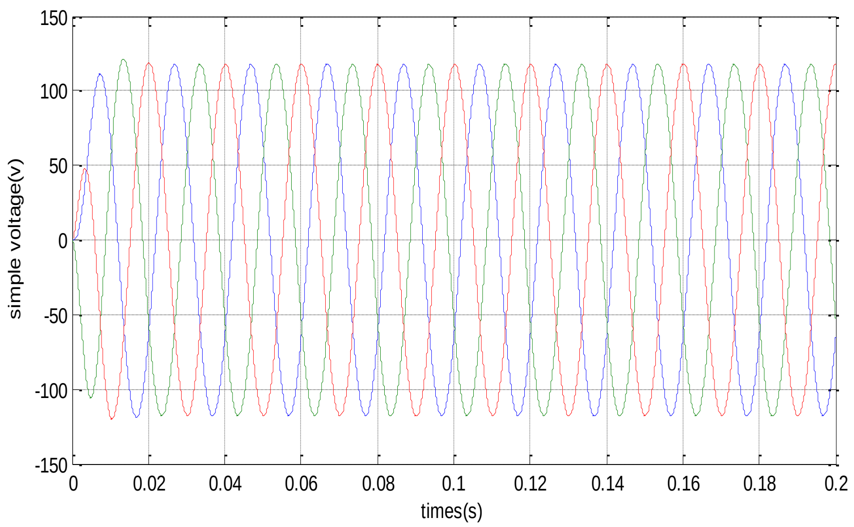

Fig.3. simple filtered voltages

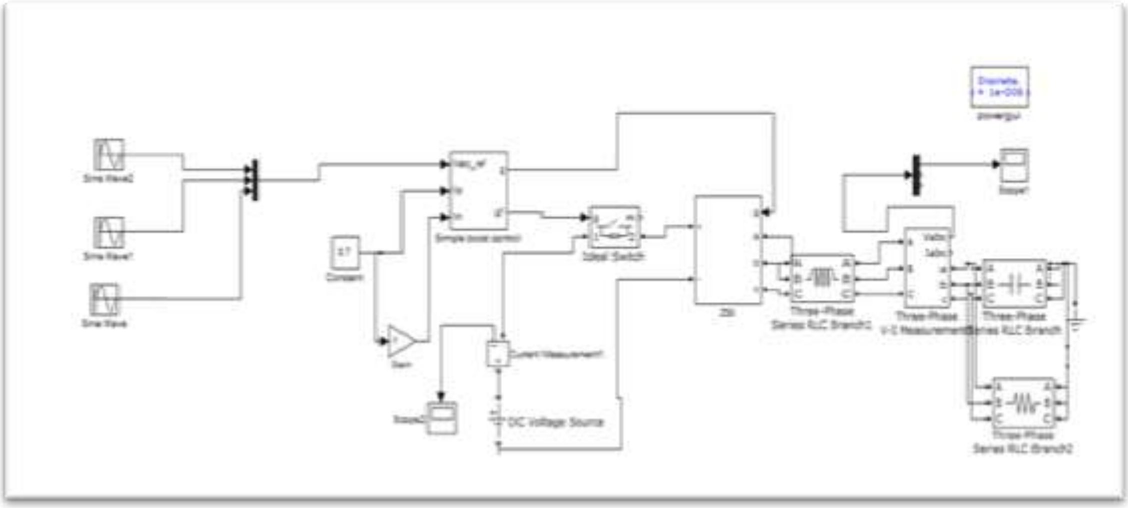

Fig.4.control SBC a z source inverter

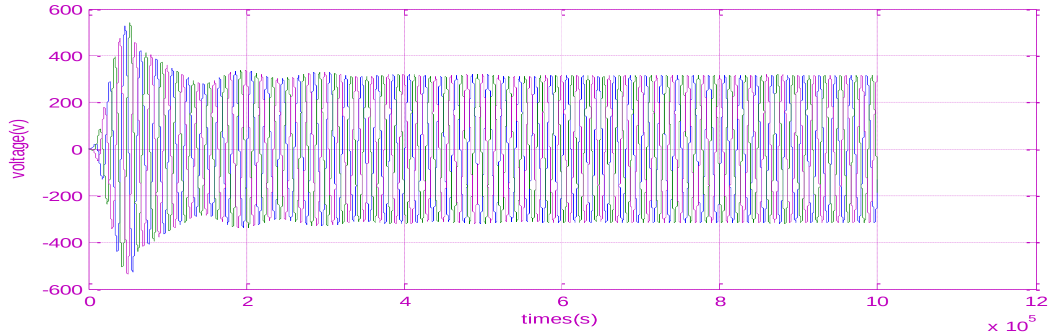

Fig.5.output voltage in bridge

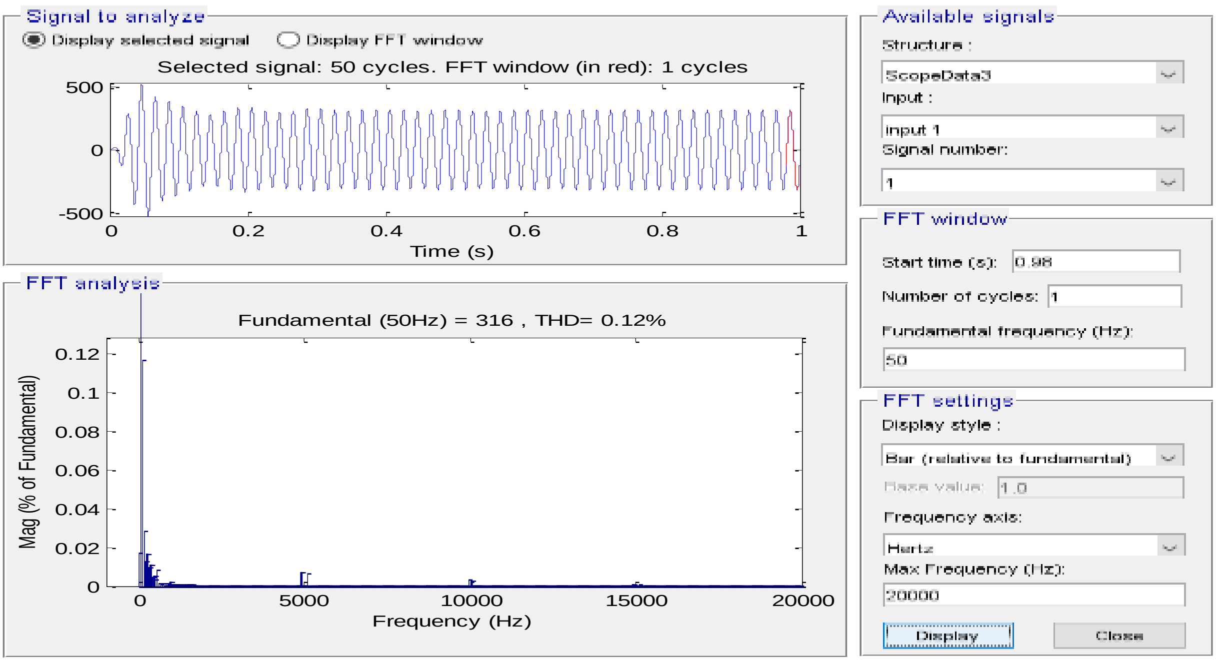

fig.6.the value of fundamental and THD

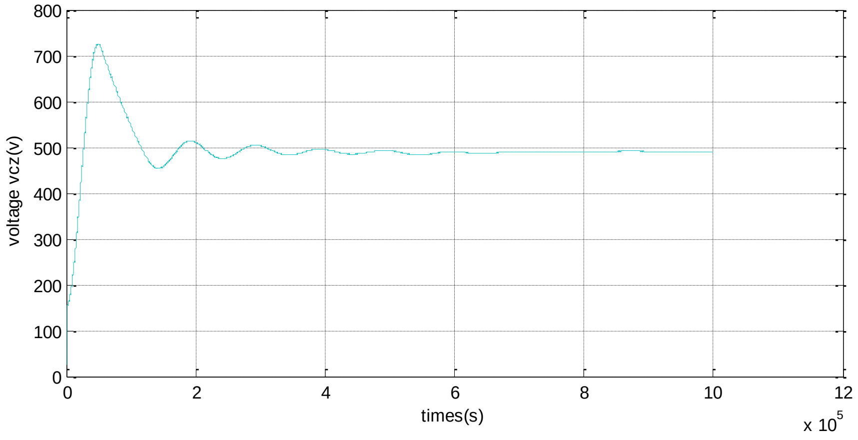

Fig.7.style of voltage vcz

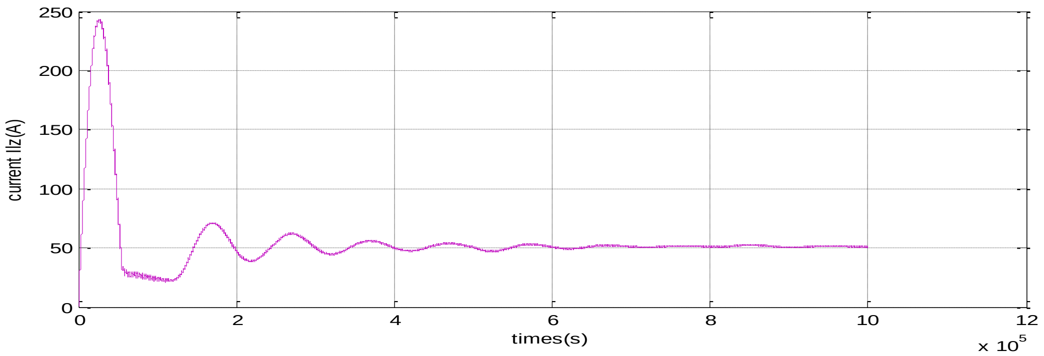

Fig.8.style of current ILz

Spectral analysis of the voltage Vcf at the load terminals gave an acceptable value of the THD. However, this value is more important than that obtained with SBC strategy.

The control of the VCz voltage and the iLz current, is achieved by two interlocking loops. Each of them gives rise to a synthesis of specific corrector.

It is observed that the VCz voltage terminals of the capacitor of the impedance network to estimate the current icz We also notice, that the current ILz changes with the change in load, this current presents a ripple rate (12%), which is acceptable in relation to the frequency of modulation used (5KHz).

These findings allow us to infer the feasibility of the control law developed by a combination of continuous and alternative magnitude control. In addition, comparing the simulation result strategy state that SBC technique has lower THD.

During my research, I have a lot of difficulties such as the lack of experience in the field and the insufficiency of motivational methods.

5.conclusion

In this paper, The SBC is a control strategy of a z-source inverter, which is developed from Sinusoidal MLI control techniques. The SBC strategy is characterized mainly by remarkable simplicity, Secondly; we have presented an impedance z source power converter. it was devoted to the development of models of control as well as the synthesis of the control law resulting from the combination of the control of continuous and alternative sizes.Finaly **.**The inverter studied in this paper is intended for the realisation of a supply chain of a load in isolated mode.for this purpose, the second control consists in ensuring constant voltages at the terminals of this load, in terms of amplitude and frequency.

References

1. F. Z. PENG, “Z-source inverter”, *IEEE Transactions on Industry Applications, vol.39, Mar-Apr 2003*

2. G.SEN ‟Voltage and current programmed modes in control of the z-source converter‟ *Master of Science, University of Akron 2008.*

3. O.ELLABBAN“Z-Source Inverter for Automotive Applications “*New Generation of Electric Vehicles, 2012.*

4. A.BATTISTON, “Modélisation, commande, et mise en œuvre des onduleurs à source impédentes”, *thèse de doctorat Université Lorraine. France 2014.*

5. P.PREETI “Performance Analysis of Different Control Methods of Z-Source Inverter Feeding Industrial Drives“*Master of engineering of power systems, Thapar University, 2012.*

6. V. S.NEVE “A literature survey on z-source inverter‟, *VSRD International Journal of Electrical, Electronics & Communication Engineering, Vol. 2 No. 11 November 2012*.