AC Voltage Analysis using Matrix Converter

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Abstract

The purpose of this thesis is to design a three phase converter, whose switching pattern is arranged in a Matrix form and the converter is commonly known as three phase Matrix converter. This AC-AC system is proposed as an effective replacement for the conventional ACDC- AC system which employs a two-step power conversion. The thesis analyzes the performance of matrix converter with two modulation techniques such as SVPWM and SVM. The basic principle and switching sequence of these modulation techniques have been presented. The output voltage, output current waveforms, voltage transfer ratio and THD spectrum of switching waveforms connected to different type of loads are analyzed by using Matlab/Simulink software.

Index terms— output voltage, output current waveforms, voltage transfer ratio.

1 I. Introduction

atrix converters are capable of AC/AC direct power conversion. It does not have any dc-link circuit and does not need any large energy storage elements. The key element of a Matrix Converter is the fully controlled four quadrant bidirectional switch, which allows high frequency operation. The matrix converter consists of 9 bi-directional switches that allow any output phase to be connected to any input phase. space-vector modulation technique is used in Matrix converter modulation technique. The SVM technique was adapted for the matrix converter by employing a basic concept of indirect modulation using a fictitious DC bus, then dividing the converter into a rectification stage and an inversion stage. Furthermore, this modulation technique allows simplifying a converter model, making it easier to control the converter under imbalanced and distorted power supply conditions. BY using this technique Matrix converter generate variable frequency.

2 II. Literature Review

This part of the thesis consists of the details of modulation technique and the switching topology of matrix converter. The working principal of most of the technique will also be explained. The main technique those are used for analysis Matrix converter are:-

3 Space vector modulation: Space vector modulation is an algorithm for the control of PULSE WIDTH MODULATION (PWM). It is used for the creation of ac

Author: Faculty of Engineering, American International University-Bangladesh (AIUB). e-mail: anubhab-sarkar578@gmail.com wave forms. It is a general technique for any threephase load, although it has been developed for motor control. Space vector pulse width modulation is applied to output voltage and input current control. This method is an advantage because of increased flexibility in the choice of switching vector for both input current and output voltage control. It can yield useful advantage under unbalanced conditions. The three phase variables are expressed in space vectors. For a sufficiently small time interval, the reference voltage vector

can be approximated by a set of stationary vectors generated by a matrix converter. The modulation process thus required consists of two main parts: selection of the switching vectors and computation of the vector time intervals. SVPWM refers to a special switching sequence of the upper three power transistors of a three-phase power inverter. It has been shown to generate less harmonic distortion in the output voltages and or currents applied to the phases of an AC motor and to provide more efficient use of supply voltage. There are two possible vectors called zero vector and Active vector.

4 Modulation technique of Matrix converter: Matrix

Converter operation can be explained in more general terms using a space vector approach. For operation of the Matrix Converter one and only one switch in each output phase must be conducting. This leads to twenty seven possible switching combinations for the Matrix Converter. By applying Equations 1 and .2 to determine the output voltage and input current vectors respectively, the magnitude and phase of these vectors for all possible combinations are needed. To find current and voltage modulation index power balance condition can be used. With balanced output load current condition such as,?? (????) ????? = (qVim?3) cos(?ot)**(1)**?? (0??) ?????? = 2 3 (v1o + av2o + ?? 2 v3o)**(2)**

Where, a = ?? ?? 2?? 3

The vector ?? (0??) ?????? has a constant length of qVin?3 and it is rotating at frequency ?o. The basis of the space vector modulation technique is that the possible output voltages for the converter can be expressed in the same form as Equation 2 The reverse blocking capability is a weak of the early IGBT technology . The advantage is that it is possible to independency control the direction of the current.

5 III. Designing of Simulink Models and Outputs

This part is carrying the whole design of Space vector modulation and Matrix converter models and analysis their outputs. In figure **??** 3? supply is provided where the frequency is used 60Hz. This fundamental frequency is modulated by SVM technique. In this technique high switching frequency is needed for triggering. In figure 4 common ammeter bidirectional switch is used where the modulated signal is used as input signal. After finishing all the switching combination inside the SVM symmetric switching part the desired frequency will be gotten.

6 IV. Conclusion

The conversion from ac to ac is quite difficult. but matrix converter makes it simple and easy. It has appeared as an alternative solution for adjustable speed AC drive applications. This thesis presented easier References Références Referencias methods for implementing complex switching strategies, studying and mitigating the effects of unbalance, and topological changes to increase the performance indices. The thesis also suggests modulation techniques to eliminate the common mode voltage and a new direct torque control procedure for controlling an induction motor fed by the modified matrix converter topology. The work also introduces a simple carrier based modulation technique, termed as the SVM technique, as an alternative way of implementing the space PWM technique for the matrix converter. Based on the analysis carried out on the original SV PWM technique, the thesis proposes a modified control algorithm. This modified algorithm reduces the input current harmonic distortion without affecting the output side performance. [1] [2]


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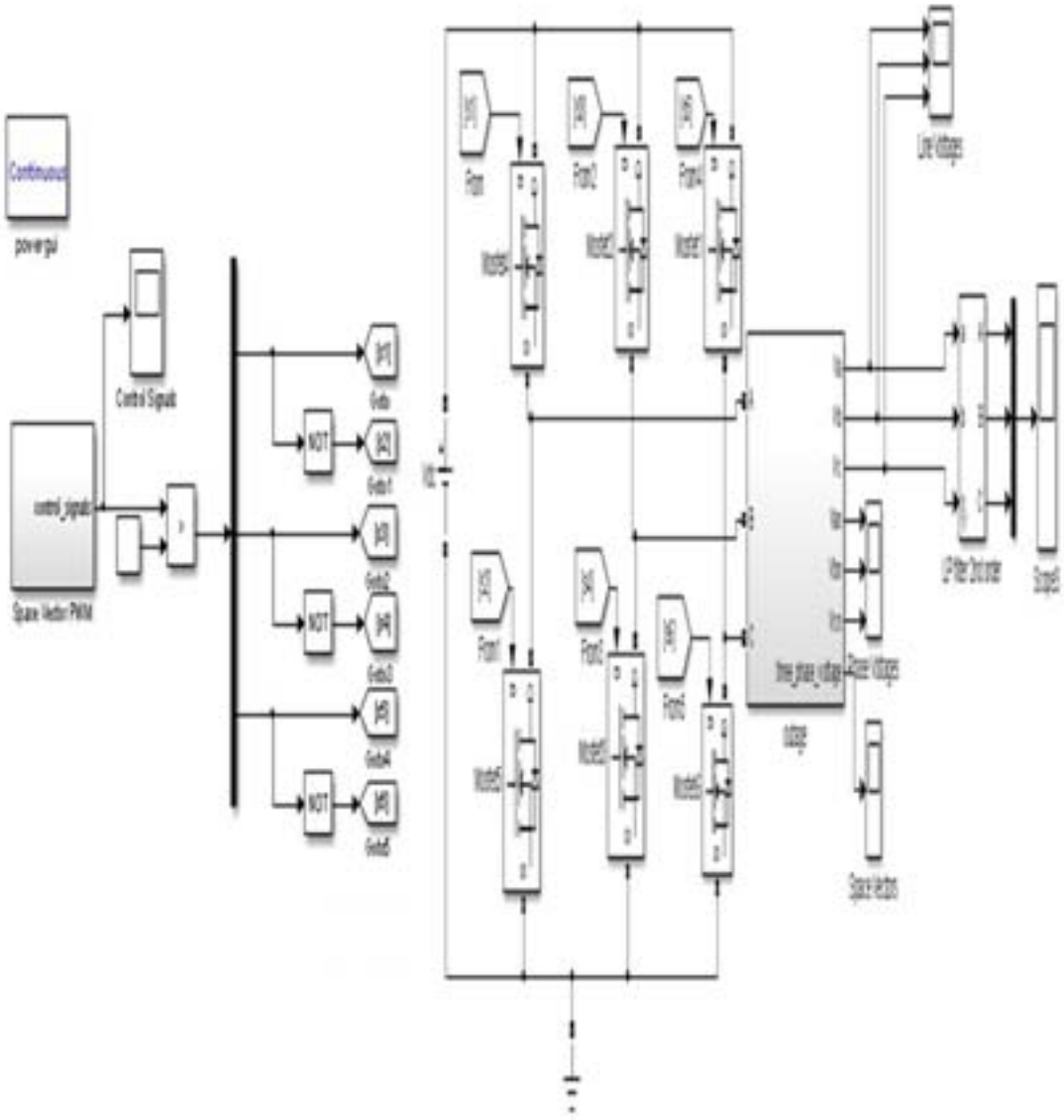
Figure 1: 1 .



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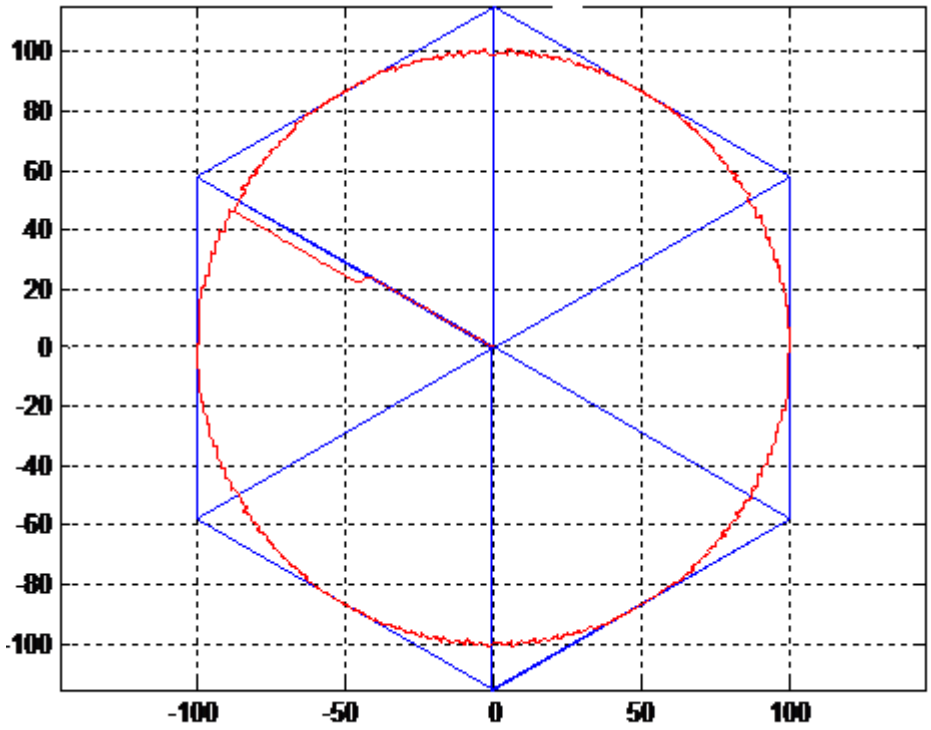

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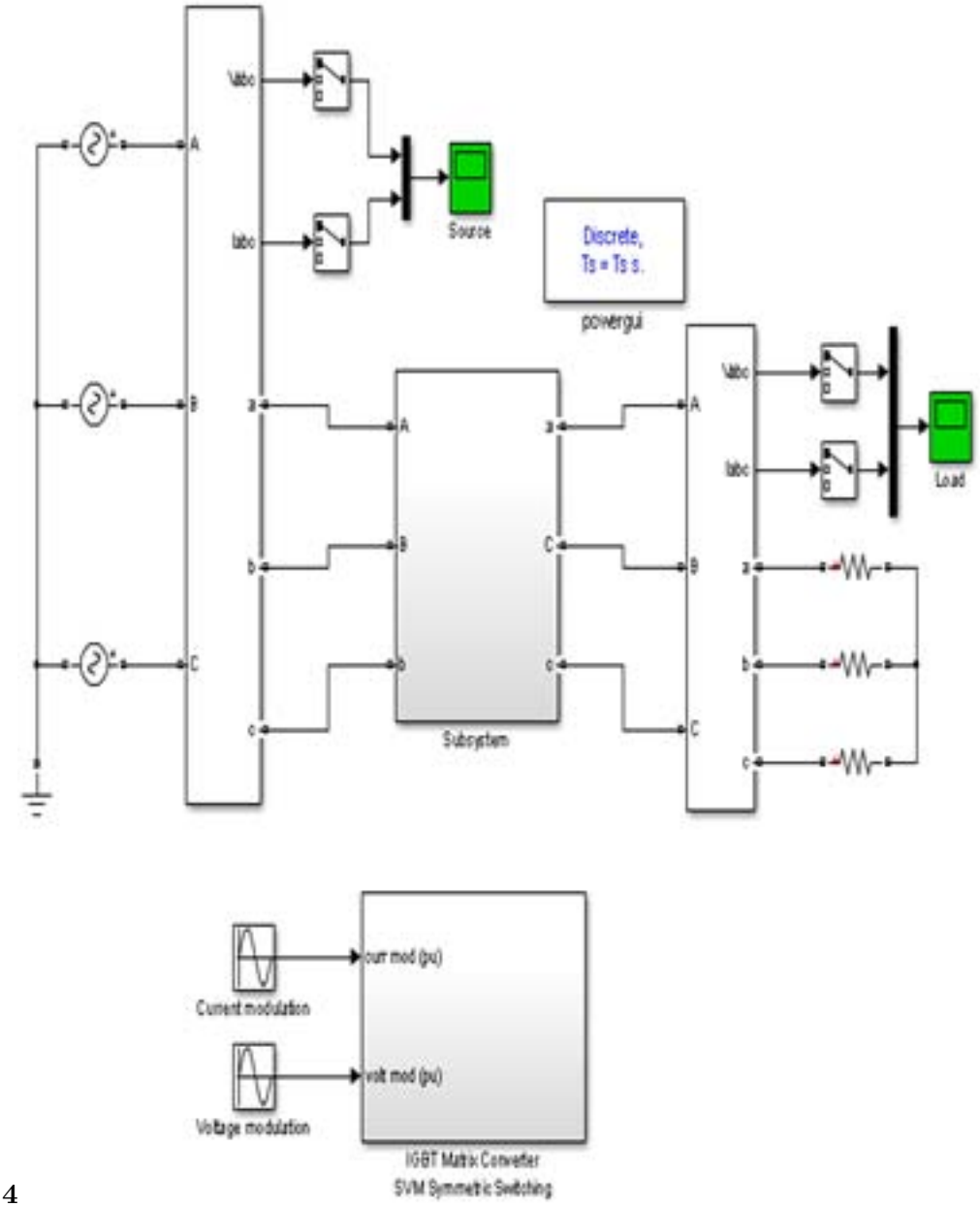
Figure 3: Figure 2 :FFigure 3 :



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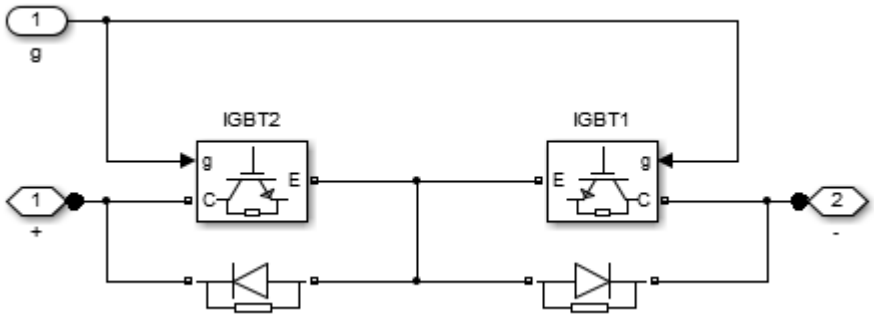

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Figure 5: Figure 5 :FFigure 7 :

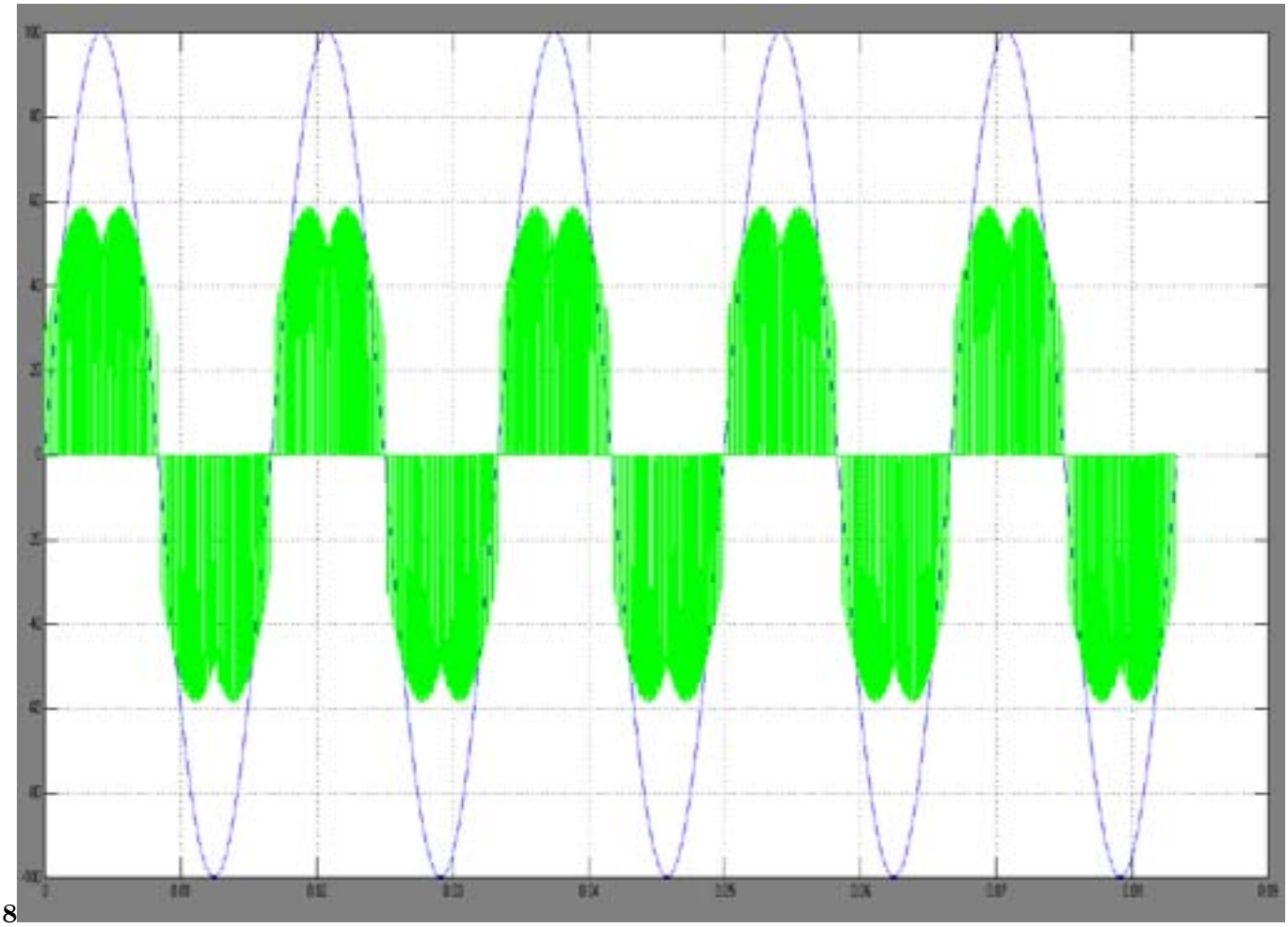

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Figure 6: Figure 8 :F

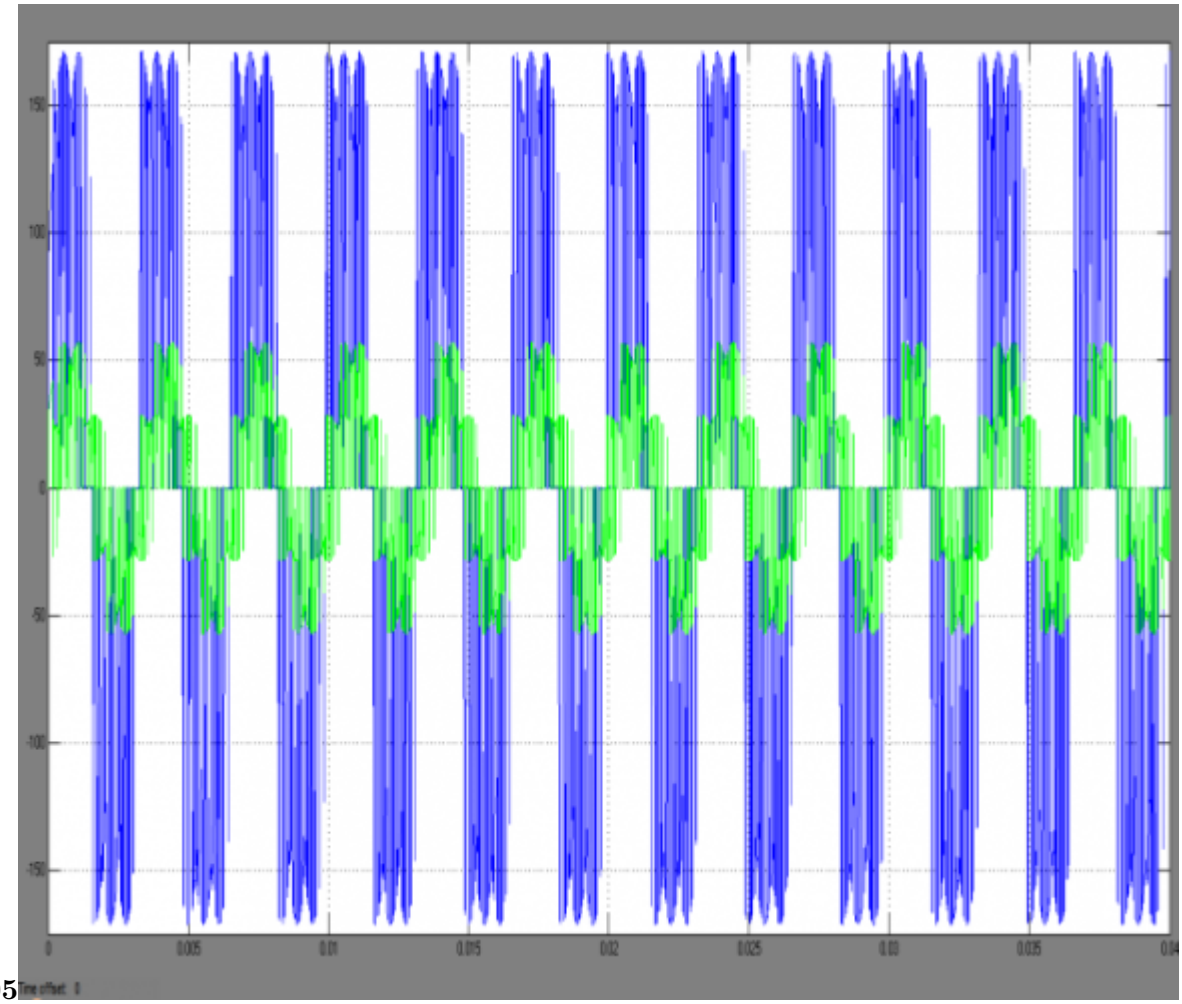

Figure 7: Figure 10 : 5 N

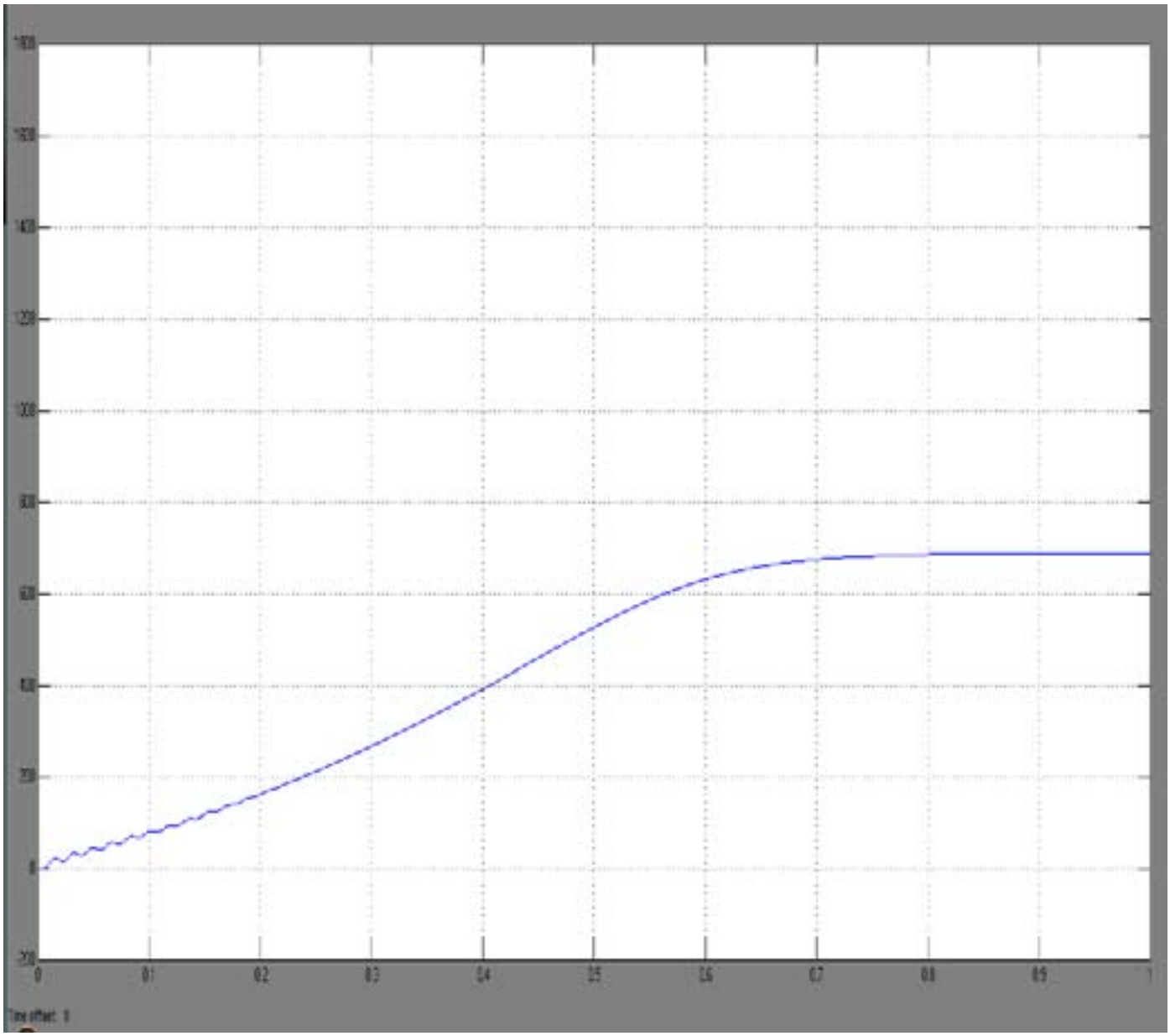

Figure 8: Global

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