Indonesian Journal of Electrical Engineering and Computer Science
Vol. 9, No. 2, February 2018, pp. 347~350
ISSN: 2502-4752, DOI: 10.11591/ijeecs.v9.i2.pp347-350

High Frequency Transformer for Ship Electrical Power System

Anu Priya K. R.[1], T. Sasilatha[2]
[1] Research Scholar, Department of Electrical Engineering (EEEM), AMET University, Chennai
[2] Dean, Department of Electrical Engineering (EEEM), AMET University, Chennai

Article Info

Article history:

Received Oct 15, 2017
Revised Dec 20, 2017
Accepted Jan 11, 2018

Keywords:

Transformer
Voltage
AC to AC
Power Electronic Technology
Matrix Device

ABSTRACT

The system represented during this paper uses 3 matrix converters and a high frequency electrical device to attain isolation and voltage transformation from primary to secondary aspect. Two matrix converters manufacture high frequency voltage across a transformer, with open all over primary. a 3rd matrix device converts the high frequency cut voltage to line frequency. The non-idealities like outflow inductance of the electrical device have a big impact on the device performance. This paper studies the impact of outflow inductance on the regulation of the output voltage of the device. The simulation study has been carried out in SIMULINK and also the results are presented.

Corresponding Author:

Anu Priya K. R.,
Research Scholar, Department of Electrical Engineering (EEEM),
AMET University,
Chennai.

1. INTRODUCTION

Fast developing power electronic technology has brought the idea of all electrical ship close to the boundary of reality [1]. Transformer is critical to supply completely different voltage levels in different hundreds. However, gift transformers occupy an oversized space. so as to scale back size, high frequency transformers are needed [2] to deal with this drawback, a high frequency power electronic topology victimization matrix converters has been planned [3]. Though, DC bus based mostly systems square measure advocated in current proposals, however since most hundreds square measure AC, 3-phase AC to AC conversion is another [4]. Therefore the topology planned uses a 3-phase AC to AC conversion. Leakage inductance is one among the vital factors that affect the performance of the device planned [5]. This paper studies intimately the consequences of discharge inductance of the transformer on the device performance planned and firefly algorithm used to generate the power [6]. The major aspects studied square measure the modification in output voltage of the converter with change frequency and discharge inductance in this method used to marine application [7]. The study is distributed in SIMULINK.

Table 1. Anti-Clockwise Vectors

MC1	MC1 MC2	MC3	Output
abc	Bca	Abc	Abc+bca
Bca	Abc	Abc	Bca+abc
Abc	Bca	Cab	Cab+abc
Bca	Abc	Cab	Abc+cab
Abc	Bca	Bca	Bca+cab
Bca	Abc	Bca	Cab+bac

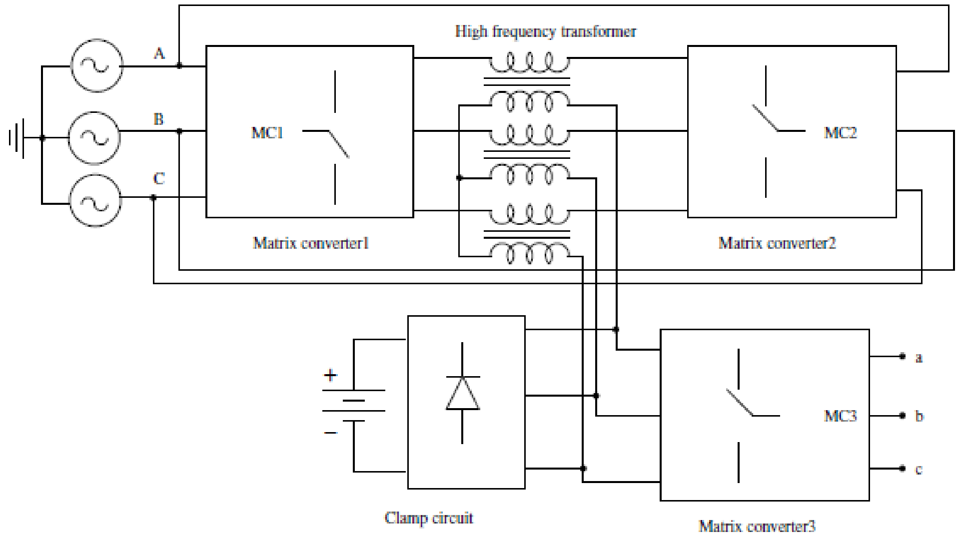

Figure 1. Matrix Converter Driven High Frequency Transformer

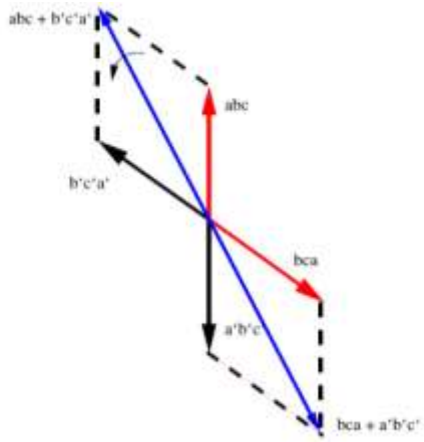

Figure 2. Vectors Applied to Transformer

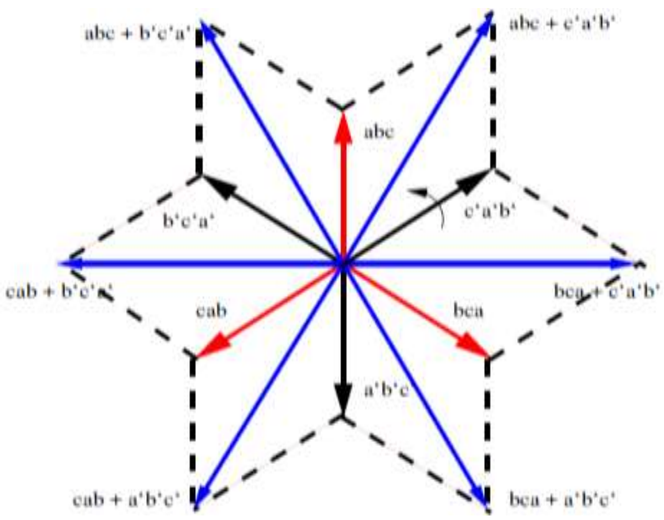

Figure 3. Output Vector from Anticlockwise Rotating Vectors

2. EFFECT OF LEAKAGE

A high frequency switched voltage seems across the transformer. Simulation results of the volatge across primary and secondary coil of the electrical device. Since the 3 matrix converters area unit switched at the same time, a high frequency switched current flows through the electrical device primary and secondary. this flowing through the secondary of the electrical device. A sensible transformer contains a definite discharge inductance [5]. Therefore, the current cannot modification in a flash within the electrical device. The discharge inductance within the transformers creates a commutation delay within the primary aspect to secondary aspect voltage transfer (Figure 4). At high frequency, the electrical device discharge impedance is proportional to f(llkpr + n2llksc), where f is frequency of excitation, llkpr, llksc are unit primary discharge and secondary discharge inductances severally and n is that the primary to secondary turns magnitude relation. The input voltage to the transformer may be a sq. wave within the switch interval [8]. There is a finite commutation amount, throughout that the direction of current changes from positive (solid) to negative (dotted) as shown in Figure 4. During the commutation interval, entire input voltage drops across the leakage [9]. The difference in the load current and secondary leakage current flows to the clamp circuit, thus producing power loss [10]-[12].

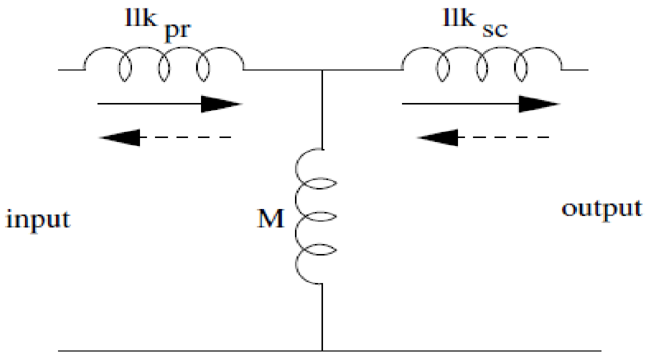

Figure 4. Transfomer with Leakage Inductance

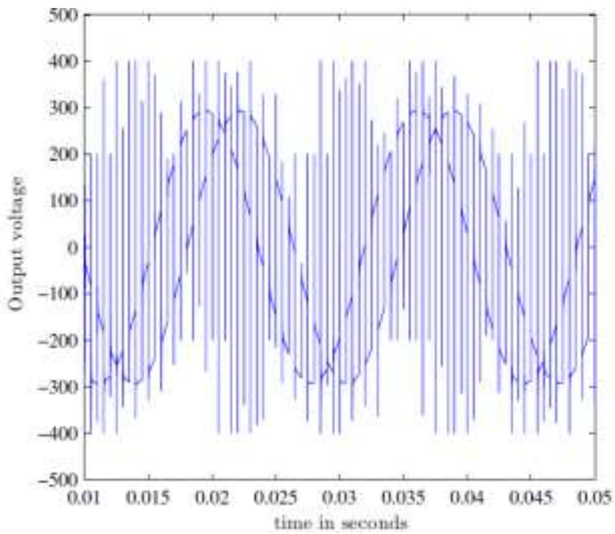

Figure 5. Output Voltage

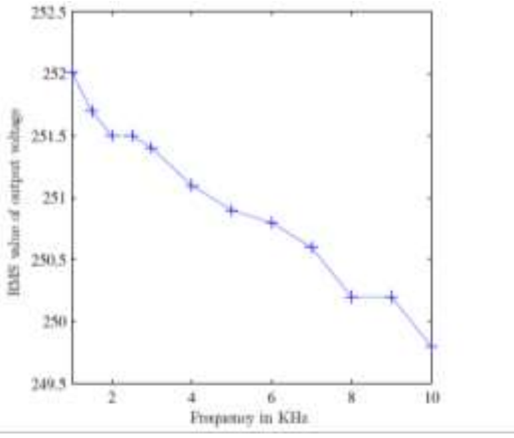

Figure 6. Decrease in Output Voltage with Increase in Frequency

3. CONCLUSION

The topology is beneficial for facility transmission and distribution electrical device. The scale of thetransformer is reduced, thereby, the price is additionally reduced. It's determined that the discharge of electrical device plays a bigrole within the output voltage regulation and overall potency ofthe system. The output voltage drops with increase in dischargeinductance or shift frequency. Therefore, it's fascinatingto Design a Electrical Device With Minimum Discharge Inductance

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