

# International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: [www.ijirset.com](http://www.ijirset.com)

Vol. 6, Issue 7, July 2017

## Power Converting Transformer with Three-Phase to Seven-Phase Conversion

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**ABSTRACT:** The main aim in this paper to build a three to seven phase AC multiphase transformers to converted into DC power through modelling and simulation. A new technique of pure seven-phase Sine-wave of fixed current/voltage and frequency is obtained now we have also used for R-L load and motor testing purposes. Here complete modelling has been simulated by using MATLAB Software. Multi-winding transformer block was taken from the sim-power system block library and turn ratios set in the dialog box then simulated. The whole modelling/design and simulation of the proposed work is presented in this paper. Seven phase transmission line system can be developed for the generation of bulk power transfer. As per need of the induction motor under a loaded condition is used for the viability of transformation system. In seven phase's, each phases shifted from the order by  $51.42^\circ$  ( $360^\circ/7$ ) and got the Sine-wave current/voltage. The novel scheme connection was expanded by using the modelling and simulation approach to prove the viability of the implementation and this type of transformer is required in aerospace engineering, railway engineering and automobile engineering applications.

**KEYWORDS**— Multiphase system, Multiphase transmission line, Three-to-Seven phases, Multi-winding transformer

### I.INTRODUCTION

The electric power from one circuit to another without changing a frequency and their mutual induction between two circuits linked by a common magnetic fluxes then this phenomenon is known as transformer [1]. It is an important element in the development of high-voltage electric power transmission line. It can be classified into various types viz. step up, step down and matching transformer [2]. Multiphase i.e. More than three phase systems are recently seen of their inherent advantage compared to the three phase counterparts. It has applicability of explored to electric power generation in multiphase systems [3-5] transmission [4-6] and utilization [7-8]. The research on seven-phase transmission line system was initiated due to the increasing a rising cost of right way for a transmission corridors, environmental program, and various stringent licensing laws [9]. Six-phase transmission lines can provide the same power capacity with a lower line voltage and smaller towers as compared to a standard double circuit three-phase line [4]. The dimension of the six-phase smaller towers may also lead to the reduction of magnetic fields and electromagnetic interference [9-10]. Generally no load test, blocked rotor and load tests are performed on a motor to determine its parameters.

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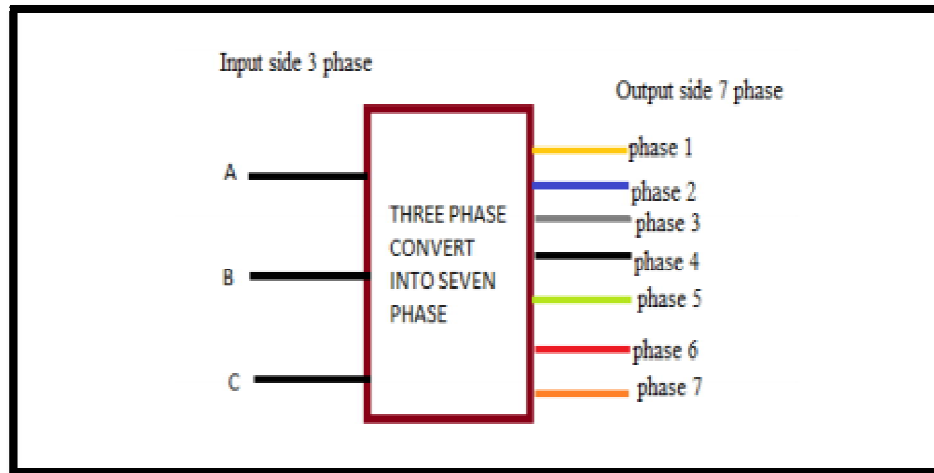


Fig. 1 Block diagram representation of the proposed system

We know that multi-phase motors are invariably supplied by ac/dc/ac converters. The multiphase electric drive is limited for the modelling and controls the supply systems [14]. Our main objective is to develop static transformation system to change the phase number from three to seven (where  $n > 3$ ). Now we are generating a novel phase transformation system which convert three phase to a seven-phase supply [15]. In multiphase system six phases and twelve phases is found to produce fewer ripples with a high frequency in an AC-DC rectifier system. Thus six and twelve phase transformers are designed to feed a number of pulses rectifier system and technology has matured [13]. Now, twenty four phase and thirty six phase transformer systems have proposed for supplying a number of pulse rectifier systems [12-16]. These designs are also available for an odd number of phases, such as five, nine and eleven etc. In this paper we have proposed a special transformer connection scheme to get a seven-phase output supply from three-phase. The expected applications of the power transformer are the electric power transmission system and power electronic converters and the multiphase electric drive system. The block represented of the proposed system is shown in figure 1. The fixed voltage and fixed frequency available grid supply can be transformed to the fixed frequency seven-phase output supply. The output may be made variable by inserting the autotransformer at the primary side. The input and output supply can be arranged in the following manner [20] as below. Input Star, Output Star. Input Star, Output heptagon. Input Delta, Output Star. Input Delta, Output heptagon. The input has being three-phase system the windings are connected in a usually fashion. The (seven phase) heptagon output connection may be derived following a similar approach. The output/secondary side connection is discussed in the following subsections.

## II. WINDING ARRANGEMENT FOR SEVEN-PHASE STAR OUTPUT

Three separate iron cores are designed with each of them carrying one primary and four secondary coils, except in one core where five secondary coils are wound. Six terminals of primaries are connected in an appropriate manner resulting in star and/or delta connections, and the 26 terminals of secondaries are connected in a different fashion resulting in a star or heptagon output. The connection scheme of secondary windings to obtain star output is illustrated in Figs. 1 and 2 and the corresponding phasor diagram is illustrated in Fig. 3. The construction of output phases with requisite phase angles of  $360/7 = 51.43^\circ$  between each phase is obtained using appropriate turn ratios and the governing phasor equation is illustrated in (1c). The turn ratios are different in each phase as shown in Fig. 1. The choice of turn ratio is the key in creating the requisite phase displacement in the output phases. The turn ratios between different phases are given in Table I. The input phases are designated with letters "X," "Y," and "Z" and the output are designated with letters "a," "b," "c," "d," "e," "f," and "g."

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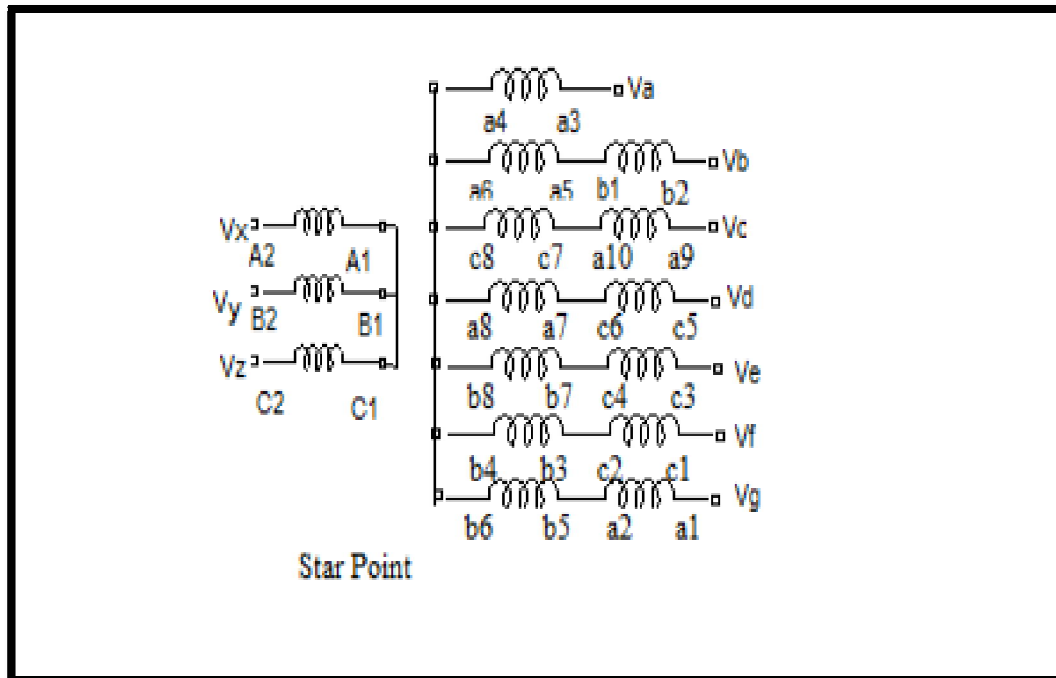


Fig. 2 Proposed transformer winding star-star connection

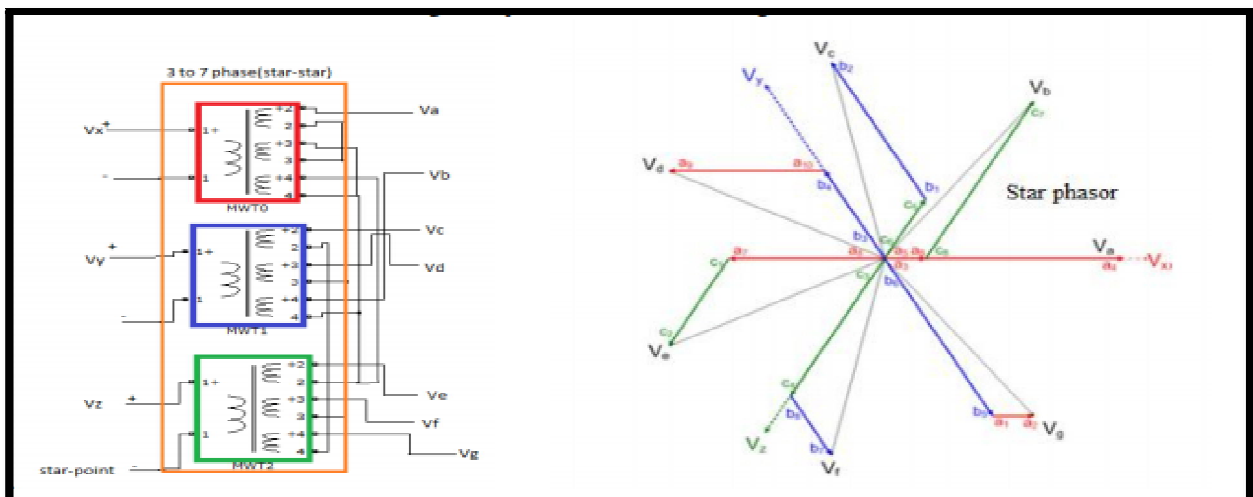


Fig. 3 (A) A new schematic diagram of a three phase to seven phases "star-star" power transformer with secondary windings and (B) Phasor diagram of the transformer connection (star-star) .

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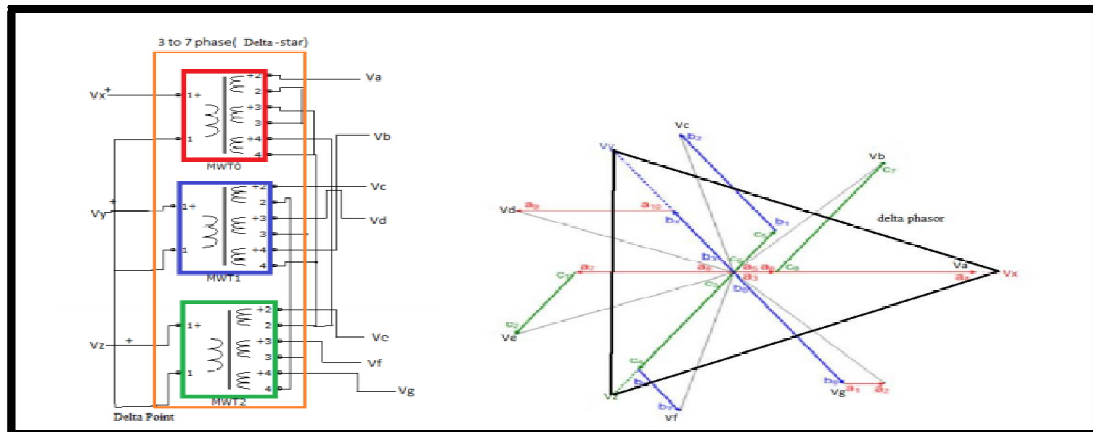
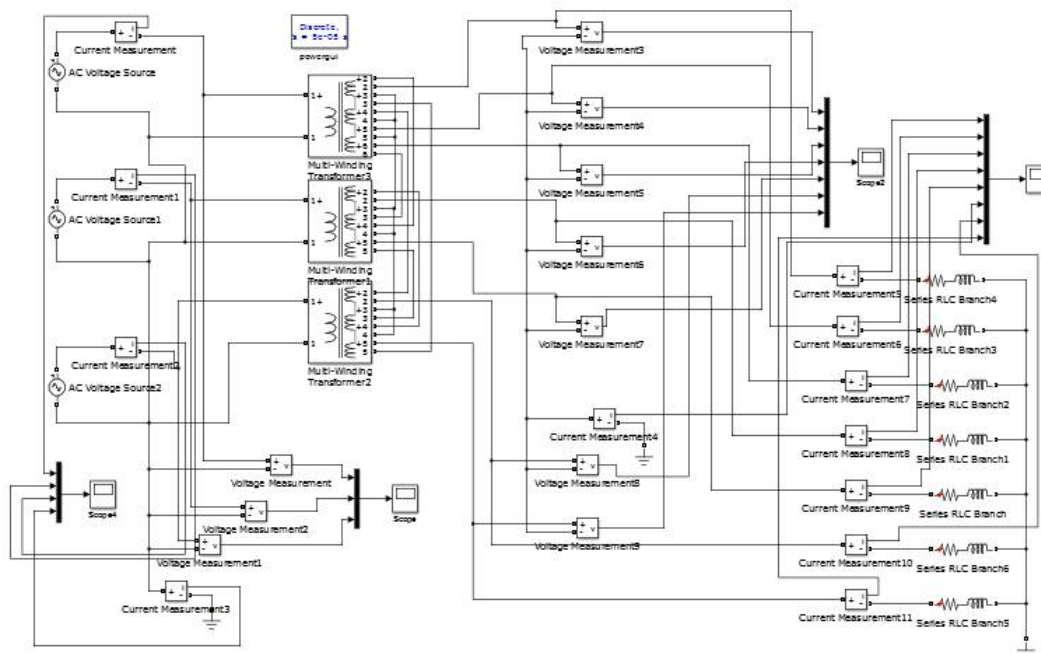


Fig.4 A new schematic diagram of a three phase to seven phases "delta-star" power transformer with secondary windings

## III.RESULTS

The three-phase to seven phase converter has been modelled and verified with MATLAB; a commercially available software package for power electronic simulations. The circuit is drawn using MATLAB software components. Digital values of voltage and current are displayed by using the display block present in the Simulink. Finally, set the run time value and run the simulation. Simulation results can be viewed by using the scope in the Simulink library

1. Matlab model of the proposed converter is shown below



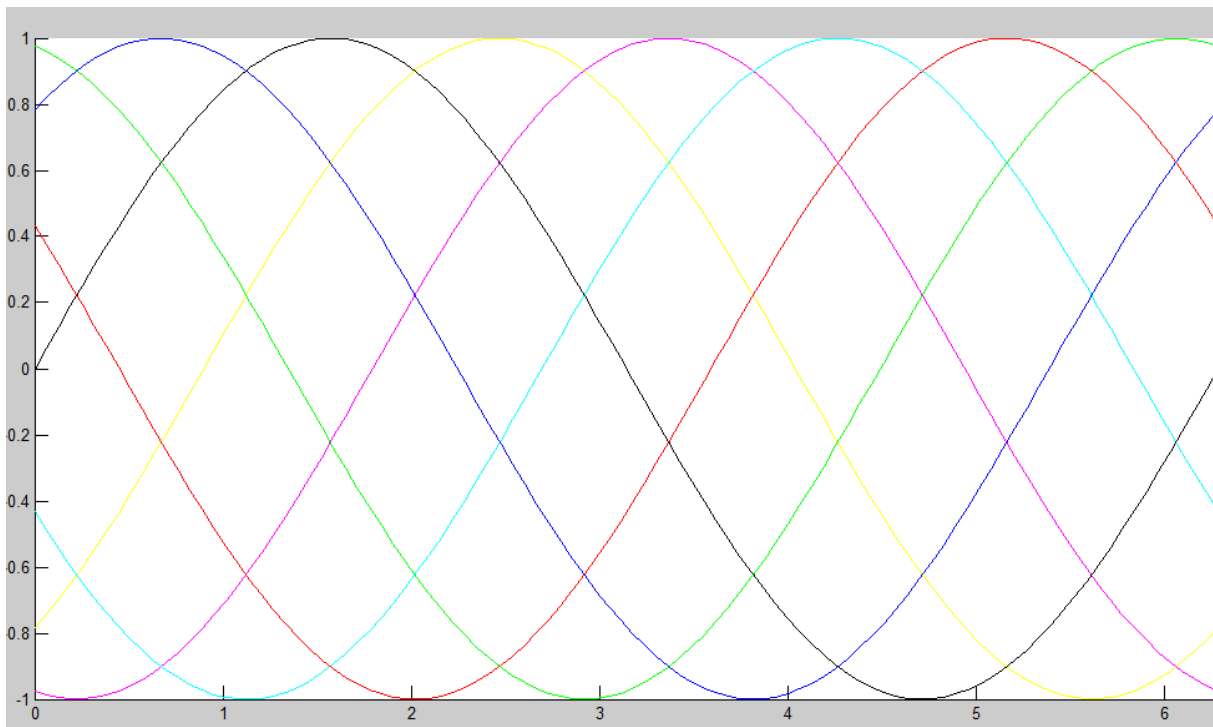
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## 2. Output waveform



## IV.CONCLUSION

This paper proposes a new transformer connection scheme to transform the three-phase grid power to a seven-phase output supply. The connection scheme and the phasor diagram, along with the turn ratios, are illustrated. The successful implementation of the proposed connection scheme is elaborated upon using both simulation and experimentation. It is expected that the proposed connection scheme can be used in drives and other multiphase applications, e.g., ac-ac and dc-ac power conversion systems

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