ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 11, November 2016

Impeccable Utility Power Obtained By the Impulsive Interphase Transformer in 12-Pulse Rectifier System

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ABSTRACT: In to the recent scenario most of the work done by using power electronics drive system. There are two types of drive one is AC drive one is DC drive. In DC drive the driver circuit works on a dc power supply. For the dc source rectifier system works. Here 12-pulse rectifier maid by two 6-pulse rectifier but if two rectifier connect directly then in supply side there are number of harmonics are produced which succeed to distorted supply current. To make supply current clean one reactor called interphase reactor have to place in between two 6-pulse rectifiers output this arrangement will reduce 3rd and 5th harmonics but cannot reduce supply harmonics to the IEEE std-519-1992. But in to this paper PWM current injection technique use to the cleaning process of the utility input current, simulation done in P-SIM simulation software and result displayed here which proves that by using this scheme clean power in utility can be obtain.

KEYWORDS: 12-pulse rectifier system, Interphase transformer (IPT), power cleaning process by IPT.PWM in IPT

I.INTRODUCTION

In to the recent electric world all applications works on to the AC voltage wave form but in to so many power electronics applications diode or SCR bridge rectifier are used. But huge harmonics, lower power factor, and large total harmonic distortion (THD) in the utility interface are common problems when nonlinear loads such as induction heating systems, adjustable speed drives, UPS systems, power supplies, and aircraft converter systems are connected to the electric utility. And in to this the nonlinear operation of the diode/SCR based rectifiers causes highly distorted input current. The non-sinusoidal shape of the input current drawn by the rectifiers causes a number of problems in the sensitive electronic equipment and in the power distribution network it also lead to the malfunction of other sensitive electronic equipment. One approach is to use a conventional twelve-pulse diode rectifier which requires two six-pulse diode rectifiers connected via Y-Y & Y-Δ isolation transformers. Here star and delta output has to be required because two 6-pulse rectifier must be operate with proper phase shift. These system results in the absence of 5thand 7th harmonics in the utility input line current. Which results in large size and cost & complexity. So rather than this an autotransformer of low kVA is employed to generate 30° phase shift between two diode bridge rectifier which drastically reduces the cost, weight & volume over the conventional system (Y-Y & Y-Δ connected 12-pulse rectifier system). In this scheme an impulsive interphase transformer is required to ensure the independent operation of two parallel connected diode bridge rectifiers. With the impulsive interphase reactor installation, the resulting input current with this approach is also near sinusoidal providing clean power utility interface. Which drastically reduces the cost, weight and volume. Many multi pulse converters have been introduced to achieve clean power such as 12-pulse 18-pulse & 24- pulse systems. As pulses increase the harmonics will be eliminate but cost and size will be increase. These multi pulse converters are formed by a combination of 6-pulse bridge rectifiers, isolation transformers. Here in to this project the operations on the 12-pulse rectifier by two 6-pulse rectifier shown using autotransformer with ratings 0.2 P0 (PU). And its outputs also shown with its simulation results. So there are three scheme first scheme is circuit without using interphase transformer and second scheme is circuit with using interphase transformer and third one is with using impulsive interphase transformer shows here and its respective results also shown to the next part in this paper. PSIM simulation results also shown in to this paper and from it the conclusion also described as by using this scheme the utility clean input can be achieve.

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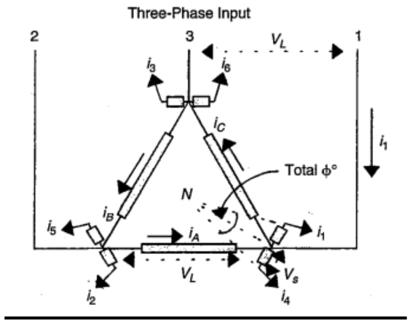
II.PRAPOSEDSYSTEM MODELS

Scheme 1: In to this scheme in 12-pulse rectifier systemthere are two 6-pulse rectifier is there and so 30 degree phase shift required in to the input side of both rectifier.But for 30 degree phase shift normaly two transformer usedby using this transformer the transformer ratings required as the same as the load.So very heavy rated transformer required and the cost of that transformer is also very high. Rather then using that transformer the new differential delta connected transformer also can be use by which the phase shift also achieve and the required rating of this transformer is nearly 10% of the load so in a view of cost it is very economical.Fig 1 shows the connection and output of the differential delta connected transformer supply given to th point 1,2 and 3 and two phase shifted output taken by point i1,i2,i3 and i4.i5,i6. And Fig.2 shows the input and output phaser arrangement of the delta connected autotransformer used in 12-pulse rectifier.



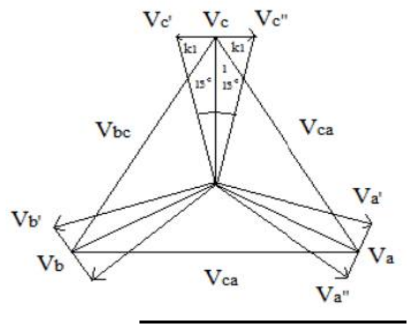


Fig.1 Connection Of Differential Delta Connected Auto Transformer [7] Fig.2 Phasers Of Input And Output[7]

This transformer connect to both supply sides of the 6-pulse converter.In to this scheme the design of delta connected transformer done by taking 0.2pu system as per the load, here 50kVA load used and for it there is only 10kVA transformer design done. Turns ratio taken by an equations as

$$n = \frac{\sqrt{3}}{\tan^{-1}\frac{\emptyset}{2}}$$

Where Φ is an half angle to the required phase shift (here 15 degree) the results of this scheme shows to the next part in to this paper.Fig.3 shows the circuit diagram representation of scheme 1

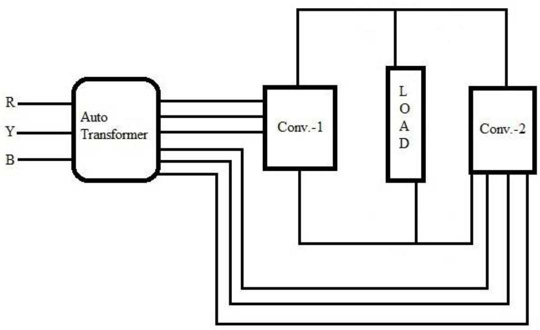


Fig.3 Connection Of Delta Connected Transformer To 12-Pulse Converter without IPT

Scheme 2: In to this scheme inter connected transformer is connect in between the outputs of both 6-pulse converter.As shown in fig.4 positive 1,2,3 output connected to one side's 6-pulse converter and negative 1,2 and 3 conedted to other side's of 6-pulse converter and Fig.5 shows the block diagram arrangement of the conventional system in which by using delta connected auto transformer and IPT used.

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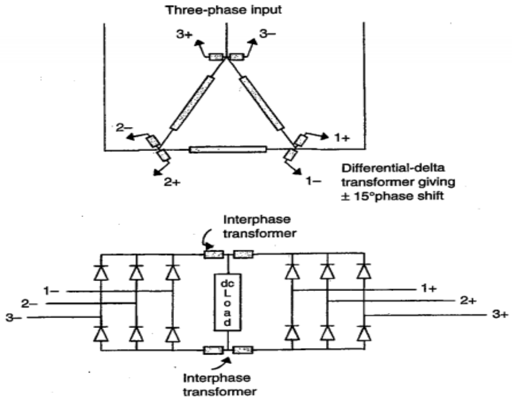


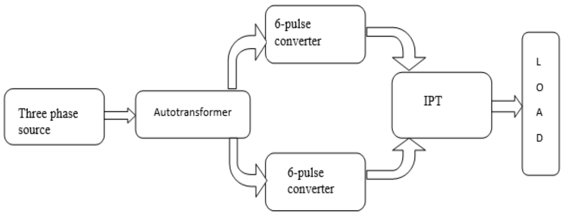
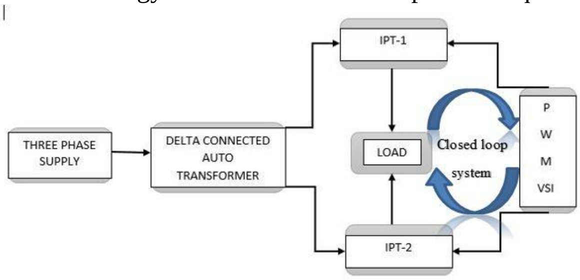


Fig.4 Connection Of Delta Connected Transformer To 12-Pulse Converter with IPT [7]

Fig.5 Block Diagram With Conventional System

The output of this proposed circuit arrangement gives proper results and more sinusoidal current in to the utility source side. Results shows to the next part in to this paper

Scheme 3: Here in use of the conventional method there is an number of harmonics create in supply side or the source side so It will effect on the output and that is totally distorted as shown in results next to it. To reduce this harmonics in to this paper new technique PWM based interphase transformer used here The current taken by the interphase transformer send to the PWM inputs according to that signal the carrier signal will change and according to that the proper output can be achieve. The output of the PWM given to the load so the closed loop system create and according to that the distortion level would be Decrease and input ustility source current will become proper and clean.Fig 6 shows the block diagram of the praposed system in which closed loop create and the clean utiity achieve. And the control strategy used in to the PWM input technique shows in to the block diagram format as shown in fig.7



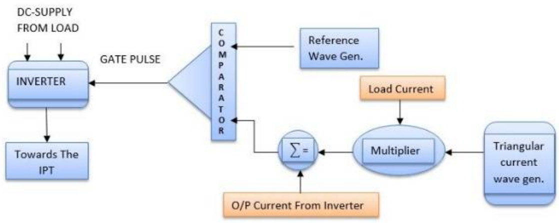
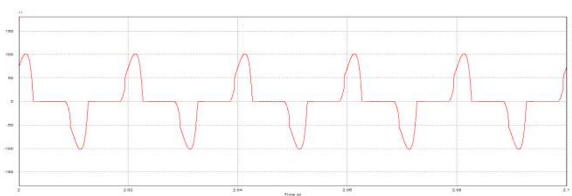


Fig.6 block diagram of the proposed system

Fig.7 Control strategy of PWM input

III. RESULT AND COMPARISION

Here in figure 8,9 and 10 shows the rectifier input current here the return path shows two peak generally in to the input of the converter so here it can shows that the proper two peak operation done by using scheme 2 and more proper can be achieve by scheme 3.



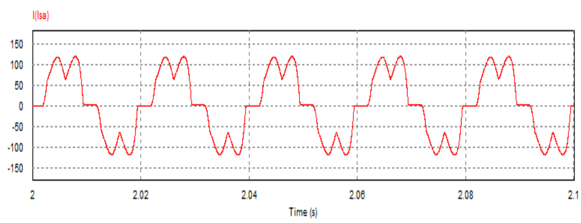


Fig.8 6-pulse rectifier input current without IPT **[scheme-1]**

Fig.9 main utility supply current with IPT **[scheme-2]**

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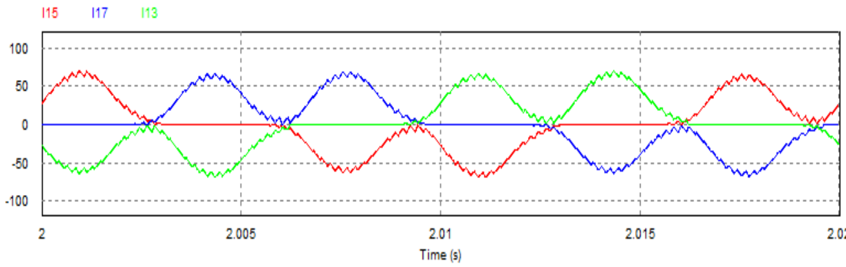
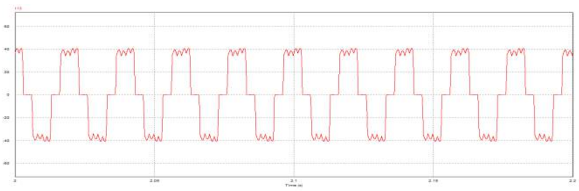


Fig.10 6-pulse rectifier input current with IPT in proposed system **[scheme-3]**

In fig 11,12 and 13 shows that the utility input current of the source during this operation of 12-pulse converter here it can shows that more sinusoidal current can be achieve by scheme 2 and more proper sinusoidal current achieve by using scheme 3.



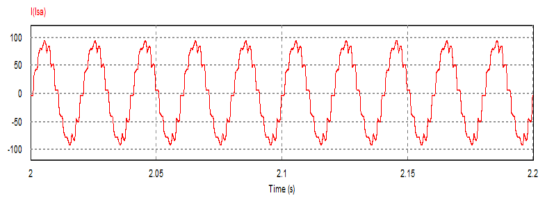


Fig.11 6-pulse rectifier input current with IPT in Conventional system **[scheme-1]** Fig.12 main utility supply current with IPT in conventional System **[scheme-2]**

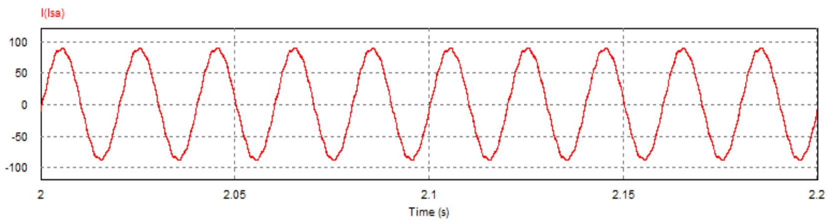
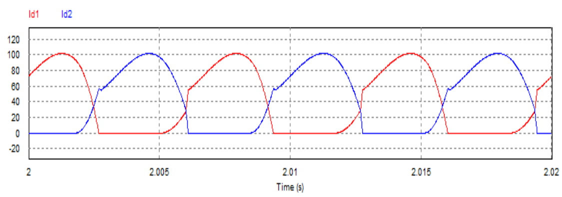


Fig.13 main utility supply current with IPT in proposed system **[scheme-3]**

Fig.14 shows by scheme 1 rectifier output here in 12-pulse rectifier the 12-puses have to get in output but because of the cross conduction (because no IPT) only 6-pulse can be achieve but by using scheme 2 and 3 the proper 12-pulse output can be achieve as shown in figure. Here fig 15 shows the results of scheme 2 and 3.



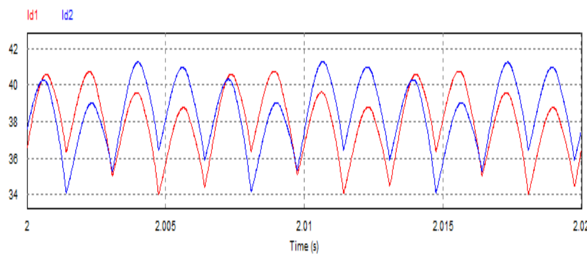


Fig.14 6-pulse rectifier output current without IPT **[scheme-1]**Fig.15 6-pulse rectifier output current with IPT in Conventional system **[scheme-2 and 3]**

Figure 16, 17 and 18 shows the results of fast Fourier transform analysis in fig.16 it shows that more harmonics available which can be eliminate by using scheme 2 and by using scheme 3 all harmonics can be eliminate as shown I fig.18.

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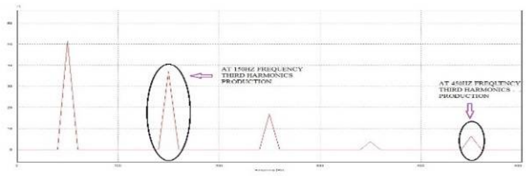

Fig.16 FFT analysis of the utility input current without IPT**[scheme-1]**

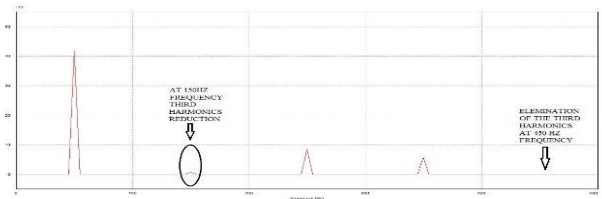

Fig.17 FFT analysis of the utility input current with IPT in conventional system **[scheme-2]**

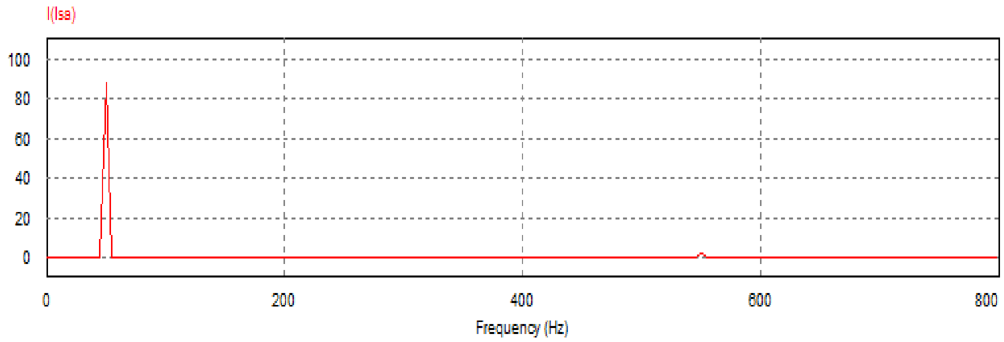

Fig.18 FFT analysis of the utility input current with IPT in proposed system **[scheme-3]**

Fig.19 shows the current which is generate by using PWM technique this current need to add in IPT current which is shows in fig.20 and fig.21 shows the real compensation process done between those currents.

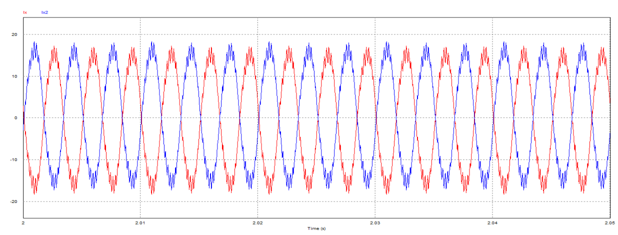

Fig.19 the current generated by PWM **[scheme-3]**

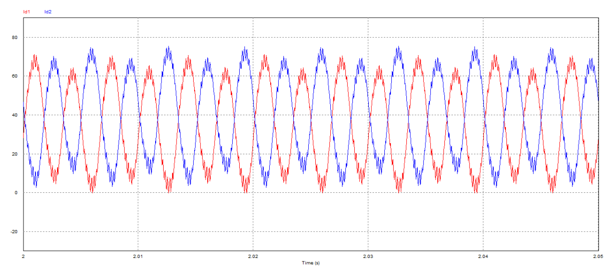

Fig.20 the current in input sides of IPT **[scheme-3]**

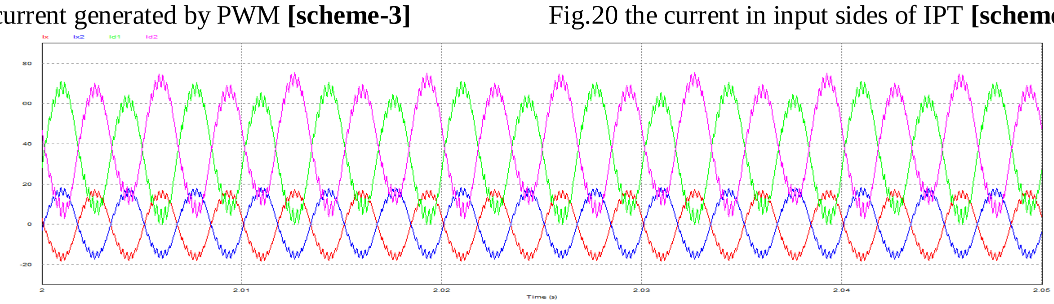

Fig.21 harmonics current compensation process done by output current of PWM in load current **[scheme-3]**

IV. CONCLUSION

After all this simulation results following conclusions can be observe. [1] By using scheme-1 here is can conclude that rather than using two winding transformer with higher ratings one differential delta connected transformer can also be use and by this the same results can be obtain as obtain in two winding transformer so this scheme is very economical, [2] by using interphase transformer over here the source side harmonics can be neglect and clean utility can be provide

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Vol. 5, Issue 11, November 2016

and [3]by using impulsive inter phase transformer the total harmonic distortion will get reduced to the standard level of 5% and here it is achieved as a level of 3.2%.

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BIOGRAPHY

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