

ZIG-ZAG TRANSFORMER-BASED CURRENT INJECTION TECHNIQUE FOR ENHANCEMENT OF POWER QUALITY IN UTILITY GRID

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Received: 14 March 2020 Revised and Accepted: 8 July 2020

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ABSTRACT: In this paper the Zig-Zag Transformer-Based Current Injection Technique for Enhancement of Power Quality in Utility Grid is implemented. The main intent of Zig-Zag transformer is to provide the winding connection in effective way. This transformer will increase the DC-Link Voltage up to three levels high of boost Converter. But the system uses only half of the boost converter inductance to implement the system. In this fuzzy control technique is used to improve the performance of power quality. Hence this is simulated in Matlab simulink power system tool. The proposed injection technique will improve the stability and power quality of system in effective way.

KEY WORDS: Zig-Zag transformers, voltage, DC-link voltage, boost convertor, Power applications, Inductance, Ripple Current, Current Injection Rectifier.

I. INTRODUCTION

DC interface voltage can be controlled utilizing corresponding proportional-integral (PI) controller, relative basic subordinate controller and fuzzy logic controller. DC interface is taken care from isolated voltage which is used to balance the DC-side voltage inside a specific range. Exchanged capacitor Active Power Filter (APF) that carries new measurement to APF as it diminishes parts and appraisals while performing at low exchanging recurrence is assessed [1]. DC voltage is utilized as a battery pack and it consists of capacitor in it, which is charged from a photovoltaic exhibit. There are fundamentally four sorts, of APFS to be specific, single stage two-wire, three-stage three wire, three-stage three-wire with Zig-Zag transformer and three-stage four wire set up to meet the prerequisites of the three kinds of nonlinear loads on flexibly frameworks.

This technique generally utilizes an inter phase reactor (IPR) with an auxiliary circuit, which empowers to induct the ideal current which can shape the information of AC line current to a sine wave. Moreover, numerous procedures came into training for reducing the sounds DC-side wave reinjection strategy is incorporated, in the same way beat multiplying technique, dynamic IPR with assistant circuits, IPR with an optional circuit, which obtains as a low pulse width modulation (PWM) current source to introduce the information line current DC-side current Injection, utilizing a loop gadgets and dynamic IPR with helper circuit comprising of vitality component [2-3].

Moreover, endeavours have additionally been made to create dynamic current Injection procedures for low and medium force applications to induct toward sinusoidal flows from the utility in errors with APF, Application of the voltage and recurrence guideline while the utilization of two-phase helper circuit at the rectifier end for power quality improvement has been introduced in. Further cutting edge PST based rectifiers and their demonstrating is point by point in individually.

These nonlinear trademark music produced by nonlinear burdens will openly go into the utility lattice through transformers. Along these lines, it unavoidably brings power-quality (PQ) issues to the HV (High Voltage) were it appropriately organizes the issues. Along these lines, it is important to perform consonant concealment and improve the matrix gracefully quality by methods for another gadget and relevant methodology. Electric force quality has become as a significant piece of intensity frameworks and electric machines. It is ordinarily utilized interchangeably with "gracefully dependability," "administration quality," "voltage quality," "current quality," "nature of flexibly," and furthermore for nature of utilization. Non straight loads, for example, switch mode power converter, heaters,

customizable speed drives, welding hardware, fluorescent lights, TV sets and so forth., cause a provoking issue to the force framework organize.

These sources are injecting current which corrupts the utility voltage. Predominantly sounds in the framework brings about a few unfriendly impacts, for example, expanded warming blocks in lines, engines and transformers, turning machine vibration, voltage quality deduction, low influence factor, Another fundamental capacity of electric influence framework is to limit receptive influence stream in gracefully and circulation frameworks, along these lines limiting the charge for responsive influence dynamic vitality this will bring about diminishing passage for electrical vitality [4].

Dynamic channel is the controllable voltage source V_c and burden is a present source. When there is no dynamic channel in the framework load Synchronous current is reconfigurable by inactive channel. Shifting trademark based upon proportion of Z_s and Z_f If source impedance is little, or except if the latent channel is tuned to Synchronous frequencies produced by the heap then the ideal channel qualities won't happens. Equal reverberation among Z_s and Z_f will likewise happen at explicit frequencies causes Synchronous Amplification [5]. consonant current will moves through source and load directions. On the off chance that we are acquainting dynamic filter in with the framework as a controllable voltage source, dynamic channel powers all the sounds contained in the source through inactive channel so no consonant current will come from the source block. Also, no central voltage is applied to dynamic channel. This outcomes in the decrease of voltage rating of dynamic channel.

II. UTILITY INTERACTIVE BASE AC-DC CONVERTER USING HARMONIC CURRENT INJECTION TECHNIQUE

One of the most well known techniques for improving force quality is the utilization of multi-beat converter based front-end AC-DC converter frameworks. Moreover, dynamic current Injection methods are ordinarily utilized in low and medium force applications to move towards the sinusoidal flows from the utility, alongside multi-beat transformers. The technology of multi-beat methods has prompted the improvement of information of power quality.

One of the techniques to improve input power quality is by utilizing multi beat converter based front-end air conditioning dc converter framework. Additionally, current Injection in dc side through dynamic gadgets is ordinarily utilized in low-and medium-power applications to move towards sinusoidal flows from the multi beat transformer. Likewise, interfacing Vienna rectifier in corresponding with a multi heartbeat rectifier for dynamic shifting is proposed.

A Zig-Zag transformer is a unique transformer with a Zig-Zag or "interconnected star" winding association, to such an extent that each yield is the vector divides in two stages which can balance by 120° . It is utilized as an establishing transformer, to allow the establishing of that impartial to an earth reference point; to perform consonant alleviation, as they can shift triplet (third, ninth, fifteenth, Twenty first, and so on.) Synchronous flows; to flexibly 3-stage power as an auto transformer (filling in as the essential and auxiliary with no detached circuits); and to gracefully non-standard, stage moved, 3-stage power.

Nine-winding, three-stage transformers ordinarily have 3 primaries and 6 indistinguishable optional windings, which can be utilized in Zig-Zag twisting association as twisting. Likewise with the delta or winding arrangement three-stage transformer, a norm, independent transformer containing just six windings on three centers can likewise be utilized in Zig-Zag winding association, such transformer once in a while being shown as a Zig-Zag transformer.

In all cases, six or nine winding, the principal loop on each Zig-Zag winding center is associated in order to the second curl on the following centre. The subsequent loops are then all integrated to frame the impartial, and the stages are associated with the essential curls. Each stage, in this way, couples with one another stage, and the voltages force. All things considered, there would be unimportant current through the impartial point, which can be attached to ground.

Every one of the three "appendages" is part of two areas. The two parts of every appendage have an equivalent number of turns which are twisted in inverse ways. With the impartial grounded, during a stage to-ground short

channel effect, 33% of the present comes back to the deficiency current, and the rest of experience two of the three stages when used to get an establishing point from a delta source.

Basically, one stages shortcoming to earth, the voltage applied to each period of the transformer is no longer in balance; transitions in the windings do not contradict anymore. (Utilizing balanced parts this is $Ia0 = Ib0 = Ic0$.) Zero-arrangement (earth issue) current exists between the transformers impartial to the nest stage .

During a stage to ground flow the Zig-Zag transformer loops attractive transition are not equivalent in the fault line. This empowers us to see zero succession. In addition you need to give the line to line voltage of the framework, greatness of the unbiased current, the System impedance per stage and to what extent will the impartial current will stream.

An improved technique for figuring the reactance and vortex current faults of transformers with non consistently carry windings is introduced in this paper. The technique has been used for quite a long while and has yielded exceptionally acceptable outcomes.

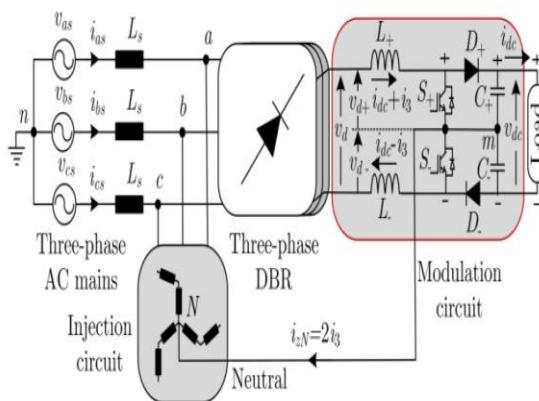


Fig. 1: Block diagram of existed system

A functioning current Injection system to improve power factor and to decrease complete Synchronous distortion is proposed. Current Injection is finished by utilizing two systems: Injection system and Injection gadget. The Injection arrange formed by a half-connect inverter working at high recurrence and Injection gadget is created by three Bi directional switches working at low recurrence. It additionally utilizes one inductor so as to get the ideal injected current. This proposed converter offers high proficiency, high force factor and furthermore absolute Synchronous bending will be decreased.

III. ZIG-ZAG TRANSFORMER-BASED CURRENT INJECTION TECHNIQUE

Zig-Zag transformer has two significant properties, specifically, no immersion with DC present and low zero arrangement impedance has high positive and negative succession impedances. So as to pass judgment on the exhibition of the proposed controller, we chose the PR controller as the mark.

The PR controller has increased generally in numerous inverter applications particularly where an amazing reference is wanted. It shows the sub titles of the internal circles of the control framework for the PR controlled UPS. Note that the controller incorporates a subsidiary controller that identifies Error1. The proposed circuit utilizes two dynamic systems Current Injection arrange: The system actualized with a half-connect inverter. The three-stage framework voltage is detected. It consists of almost which produces the third Synchronous current synchronized along with the AC mains. This consists of two switches and one inductor that work at High recurrence.

This system primary job depends on creating the ideal current load is on making the circuit versatile to any variety. Current Injection gadget. The present Injection gadget partitions the current provided by the present Injection organize into three equivalent parts and infuses them back to the injection lines.

It depends on three bidirectional changes associated with the three gracefully stages. The Injection gadget chooses the piece of the inductor current to be infused into the individual stage. The related switches work at low recurrence equivalent to the block of the source flexibly recurrence.

The waveforms of proposed arrange for one stage. In terms somewhere in the range of 180degree and 360degree could be found like the first semi-cycle. The below figure (2) shows the block diagram of proposed system. fuzzy logic controller will impove the quality of power. AC-DC converter is used for effective energy management. modulation circuit will modulate the amount of power supply to the load.

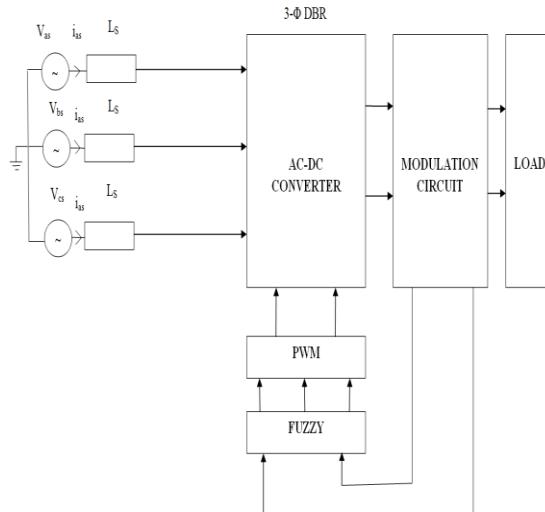


Fig. 2: Block diagram of proposed system

Current Injection organize executed with a half extension inverter comprising of two IGBTs with help of an inductor. The circuit of the inverter will perform its operation when When Q1switches off at the most extreme positive current, the inductive voltage VL turns around its extremity, the voltage transforms Vb2 and forward inclinations D2, permitting the root of current until the load current at zero, when Q2 will begin the progression of current the negative way. The rectifiers that apply uninvolved segments i.e., Transformers, inductors, capacitors, and diodes. When the negative current arrives at its most extreme worth, Q2 turns off, VL inverts, transcending Vb1 and forward biasing diode D1, load Current.

Three kinds of current Injection are dissected: the third-Synchronous sinusoidal current Injection the ideal current Injection , and the square-wave current Injection . The third-Synchronous current Injection gives the info current THD (Total Harmonic Distortion) of about 5%, however the present Injection arrange is required to fulfill a resounding limitation. The ideal current Injection gives information in the form of sinusoidal and this will take the power by the present Injection arrange. The last gathering of rectifiers, that apply square wave current Injection, gives complete Synchronous form to the input values about 15%, yet these sorts of rectifiers require easiest hardware, and don't require any full limitations to be fulfilled.

IV. RESULTS

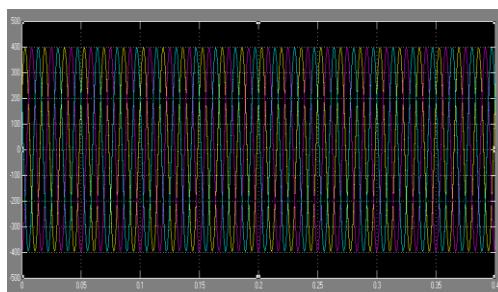


Fig. 3: Input phase voltage for the proposed front-end converter under load variations

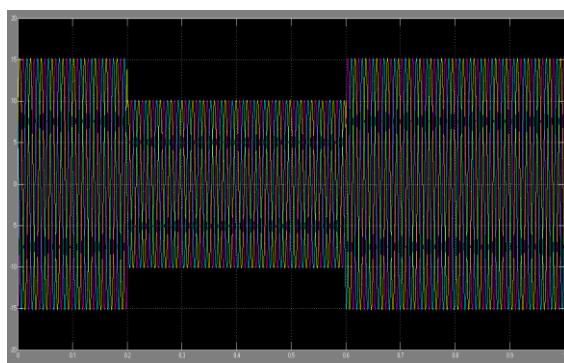


Fig. 4: Input phase current for the proposed front-end converter under load variations

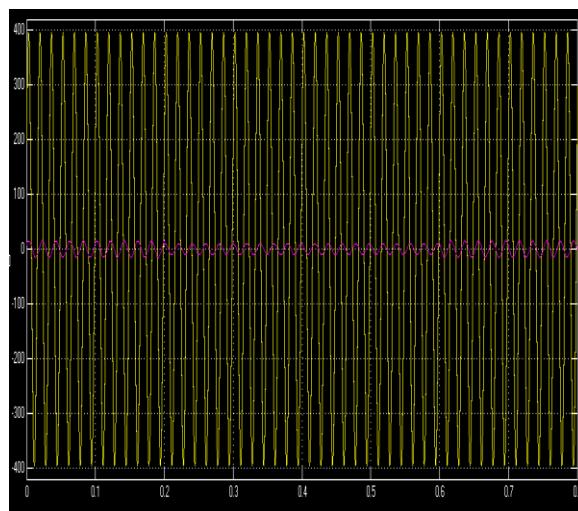
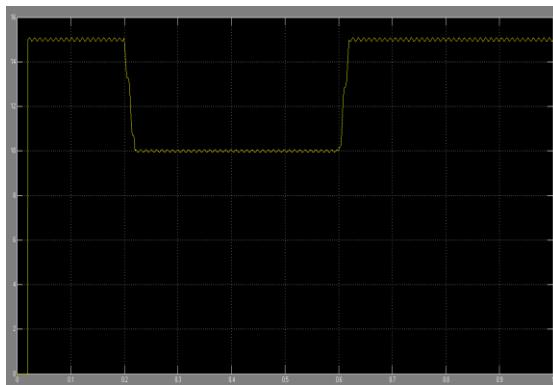


Fig. 5: Input voltage and current for the proposed front-end converter under load variations



Fig. 6: DC-link voltage for the proposed front-end converter under load variations

**Fig. 7: DC current for the proposed front-end converter under load variations**

V. CONCLUSION

Hence in this paper the Zig-Zag Transformer-Based Current Injection Technique for Enhancement of Power Quality in Utility Grid is implemented. The Zig-Zag transformer will provide the winding connection in this system. The improvement of the DC-Link Voltage up to three levels is done. In this fuzzy control technique is used to improve the performance of power quality. Hence this is simulated in Matlab simulink power system tool. The proposed injection technique will improve the stability and power quality of system in effective way.

VI. REFERENCES

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Acknowledgement:

The authors are greatly acknowledged DST - FIST (Govt.of India) for funding to setting up the research computing facilities at R.V.R & J.C College of Engineering.



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