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Power Quality Conditioning in LV Distribution Networks: Results By Field Demonstration

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Abstract - In this research work, the multi converter unified power quality conditioner is proposed for power sharing compensation of voltage and current imperfections. Another arrangement of an UPQC known as the MC-UPQC (multi-converter unified power quality conditioner) is exhibited. The framework is enhanced by including a series VSC in an adjoining feeder. MC-UPQC (unified power quality conditioning system), fit for synchronous compensation for current and voltage in multi-feeder/multi-bus frameworks. Finally, this work analyses the performance of existing and proposed configuration and validate the simulation results. Experimental results demonstrate that proposed technique is more efficient as compared to the existing techniques.

Keywords – Unified power quality controller, mc-upqc, power quality, vsc.

I. INTRODUCTION

Power quality and power electronics are unavoidably connected together as it endeavors to progress both expansive regions. With the emotional increments in the course of the most recent 20 years in vitality transformation frameworks using power electronic gadgets, it is seen that the development of 'intensity quality' and basic control calculation alteration to this equivalent innovation can regularly assume a similarly predominant job in improving in general nature of electrical vitality accessible to end-clients.

With the use of present day cutting edge microchip based advancement in modern structures for various applications, control age and electrical dissemination through sustainable power source framework, the power quality are being debased. To make the idea of items, the power supply should be of high caliber. The power electronic based equipment will display a non-straight burden trademark to the framework and making the sounds in the system. The consonant flows increase the RMS estimation of the current and make the impartial current to course in the appropriation arrange .The closeness of sounds lessens the circulation limit and addition the misfortunes. Poor power quality in a system could be due to different factors such as voltage sag, voltage swell, voltage outage and over correction of power factor and unacceptable levels of harmonics in the current and voltage.

Modern solution for poor power quality is to take advantage of advanced power electronics technology .Recent research efforts have been made towards utilizing a device called unified power quality conditioner (UPQC) to solve almost all power quality problems. The main purpose of a UPQC is to compensate for supply voltage flicker/imbalance, reactive power, and harmonics. In other words, the UPQC has the capability of improving power quality at the point of installation on power distribution systems or industrial power systems. The UPQC, therefore, is expected as one of the most powerful solutions to large capacity loads sensitive to voltage flicker/imbalance[1].

II. BACKGROUND

UPQC has many real time applications. But still has several technological lacunas in the technique of background subtraction. In this section, several methods are briefly discussed.

Singh et al. presents another unified power-quality conditioning system (MC-UPQC), fit for concurrent pay for voltage and current in multi-transport/multi-feeder frameworks. In this setup, one shunt voltage-source converter (shunt VSC) and at least two arrangement VSCs exist. The framework can be connected to contiguous feeders to make up for supply- voltage and burden current flaws on the fundamental feeder and full remuneration of supply voltage imperfections on different feeders. In the proposed arrangement, all converters are associated consecutive on the dc side and offer a typical dc-connect capacitor. Consequently, power can be exchanged from one feeder to contiguous feeders to make up for hang/swell and interference. The presentation of the proposed arrangement has been checked through reproduction contemplate sutilizing MATLAB/recreation on a two- transport/two-feeder framework and results are introduced. Contrasted with a regular UPQC, the proposed topology is prepared to do completely ensuring basic and delicate burdens against twists, droops/swell, and interference in two-feeder frameworks. The thought can be hypothetically reached out to multi-transport/multi-feeder frameworks by including more arrangement VSCs[2].

Prasad et al. presents topology outlines the task and control of Multi Converter Unified Power Quality Conditioner (MC- UPQC). The framework is stretched out by including an arrangement VSC in a contiguous feeder. The gadget is associated between at least two feeders originating from

various substations. A non-straight/touchy burden L-1 is provided by Feeder-1 while a delicate/basic burden L-2 is provided through Feeder-2. The exhibition of the MC-UPQC has been assessed under different aggravation conditions, for example, voltage list/swell in either feeder, deficiency and burden change in one of the feeders. If there should be an occurrence of voltage hang, the stage point of the transport voltage in which the shunt VSC (VSC2) is associated assumes a significant job as it gives the proportion of the genuine power required by the heap. The MC-UPQC can alleviate voltage droop in Feeder-1 and in Feeder-2 for long term [3].

Banra et al. introduced another unified power-quality conditioning system (MC-UPQC). The reaction of the Multi converter bound together power quality conditioner, for enlistment engine load is contemplated. MCUPQC is fit for concurrent remuneration for voltage and current in multi-transport/multi-feeder frameworks on the dissemination side. In this setup, one shunt voltage-source converter (shunt VSC) and two arrangement VSCs exist. This framework can be connected to express feeders which straightforwardly interface with non-direct/delicate and basic burdens, to adjust for supply-voltage and burden current flaws on the primary feeder and full pay of supply voltage blemishes on different feeders. In the proposed arrangement, all converters are associated consecutive on the DC side and offer a typical DC-connect capacitor. Accordingly, power can be exchanged from one feeder to contiguous feeders to adjust for list/swell and intrusion. So as to direct the DC-connect capacitor voltage, traditionally, a corresponding controller (PI) is utilized to keep up the DC-interface voltage at the reference esteem. The control methodologies utilized for arrangement and shunt voltage source converters are sinusoidal heartbeat width tweak voltage control and hysteresis current control separately. The exhibition of the proposed arrangement has been confirmed through reproduction examines utilizing MATLAB/SIMULATION on a two-transport/two-feeder framework [4].

Singh et al. presents another unified power-quality conditioning system (MC-UPQC), fit for synchronous remuneration for voltage and current in multi-transport/multi- feeder frameworks. In this arrangement, one shunt voltage- source converter (shunt VSC) and at least two arrangement VSCs exist. The framework can be connected to contiguous feeders to adjust for supply-voltage and burden current defects on the principle feeder and full pay of supply voltage flaws on different feeders. In the proposed setup, all converters are associated consecutive on the dc side and offer a typical dc- interface capacitor. Accordingly, power can be exchanged from one feeder to contiguous feeders to make up for hang/swell and interference. The exhibition of the MC-UPQC just as the received control calculation is delineated by reenactment. The outcomes got in PSCAD/EMTDC on a two-transport/two-feeder framework demonstrate the adequacy of the proposed arrangement[5].

Azharuddin et al. presents another unified power quality Conditioning System (MC – UP QC), Capable of

Simultaneous remuneration for voltage and current in multi-transport/multi-feeder frameworks .In this Configuration, One Shunt Voltage – Source Converter (Shunt VSC) and at least two administrations VSCs exist. In this way, Power can be changed from one feeder to neighboring feeders to make up for droop/swell and interference. The proposed topology can be utilized for concurrent pay of voltage and current defects in the two feeders by sharing force pay capacities between two neighboring feeders which are not associated. The reproduction results demonstrate that a lot of intensity misfortune decrease, under voltage alleviation, and the upgrade of voltage security edge can be acquired with a proper situation of the MC-UPQC in an appropriation arrange. The presentation examination of the MC-UPQC with one recently detailed structure approach demonstrates that it is progressively productive in under voltage moderation[6].

Rajani et al. presents another unified power quality conditioning system (MC-UPQC), The reaction of the Multi converter bound together power quality conditioner, for various kinds of controllers are considered. This paper equipped for synchronous remuneration for voltage and current in multi-transport/multi-feeder frameworks. In this arrangement, one shunt voltage-source converter (shunt VSC) and at least two arrangement VSCs exist. The framework can be connected to contiguous feeders to adjust for supply-voltage and burden current blemishes on the principle feeder and full pay of supply voltage defects on different feeders. In the proposed design, all converters are associated consecutive on the dc side and offer a typical dc-connect capacitor. Along these lines, power can be exchanged from one feeder to neighboring feeders to make up for droop/swell and intrusion. So as to direct the dc-connect capacitor voltage, routinely, a corresponding controller (PI) is utilized to keep up the dc- interface voltage at the reference esteem. The detailed recreation considers are completed to approve the proposed controller. The presentation of the proposed design has been confirmed through reenactment contemplates utilizing MATLAB/SIMULATION on a two-transport/two-feeder framework [7].

Ramakrishna et al. presents another unified power-quality conditioning system (MC-UPQC), fit for concurrent compensation for voltage and current in multibus/multifeeder frameworks. In this arrangement, one shunt voltage-source converter (shunt VSC) and at least two arrangement VSCs exist. The framework can be connected to advertisement jacent feeders to make up for supply-voltage and burden current defects on the principle feeder and full remuneration of supply-voltage blemishes on different feeders. In the proposed configuration, all converters are associated consecutive on the dc side and offer a typical dc-interface capacitor. Consequently, power can be exchanged from one feeder to contiguous feeders to adjust for hang/swell and intrusion. The presentation of the MC-UPQC just as the received control calculation is represented by reenactment. The outcomes acquired in Simulink on a two-transport/two-feeder framework demonstrate the adequacy of the proposed design[8].

Teke et al. focused on the converter topologies and the control calculations. Various UPQC topologies have been checked on. With this investigation, the discoveries of UPQC thinks about in the writing and the application notes of upqc's in administration are introduced and along these lines the patterns of upqc during that time are plainly watched [9].

Rao et al. presents a power quality improvement by utilizing multi converter unified power-quality conditioning system (MC-UPQC), it will give the accompanying multi capacities: responsive power pay, symphonious remuneration, flash/lopsidedness pay and voltage droop/swell in multi transport/multi feeder frameworks. With this topology the supply voltage changes on the two feeders and current vacillations on principle feeder is redressed. In this framework the three VSCs are associated consecutive with a typical dc- connect capacitor. Hang/swell and interference are remunerated by exchanging the power starting with one feeder then onto the next feeder[10].

III.PROPOSEDWORK

In the proposed, another arrangement of an UPQC known as the MC-UPQC (multi-converter unified power quality conditioner) is exhibited. The framework is enhanced by including a series VSC in an adjoining feeder. The proposed topology can be utilized for concurrent voltage compensation and current defects in the two feeders by sharing compensation capabilities of power between two nearby feeders that are not associated. The framework is likewise able of compensating for intrusions without the requirement for a storage battery.

In the proposed design, MC-UPQC (unified power quality conditioning system), fit for synchronous compensation for current and voltage in multi-feeder/multi-bus frameworks. In this setup, one shunt VSC (shunt voltage-source converter) and at least two series VSCs exist. The framework can be connected to adjacent feeders to make up for load current imperfections and supply voltage on the principle feeder and full compensation of supply voltage flaws on alternate feeders. All converters are associated consecutive on the dc side and offer a typical dc-link capacitor. Along these lines, power can be exchanged from one feeder to neighbouring feeders to adjust for sag/swell and intrusion. The proposed topology can be utilized for current imperfections and simultaneous voltage compensation in the two feeders by sharing compensation of power capacities between two adjoining feeders that are not associated. The framework is capable for intrusions of compensating without the requirement for a battery storage framework and thus without limitations of storage capacity. The execution of the MC-UPQC and additionally the algorithm of adopted control can be delineated by simulation.

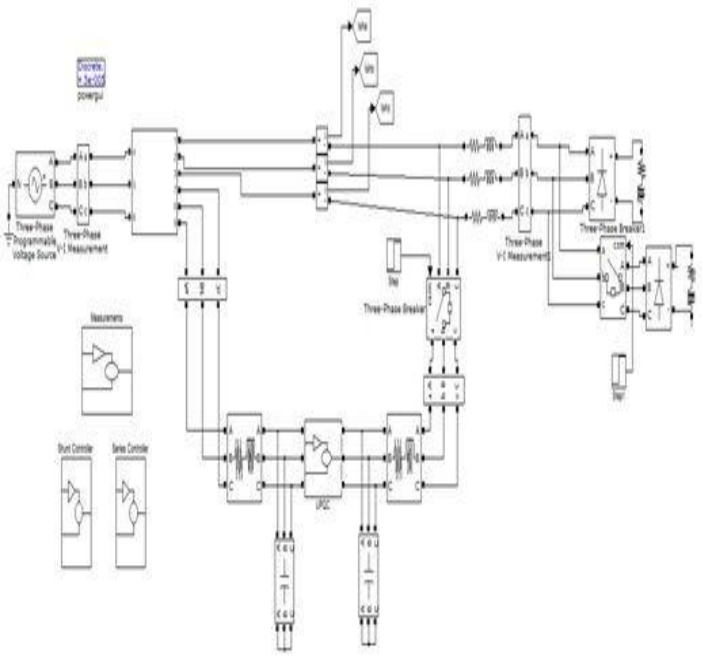


Figure 1: Main upqc proposed model

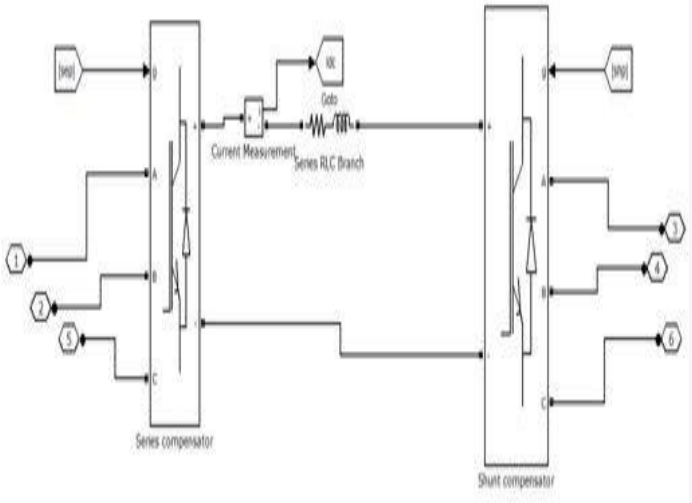
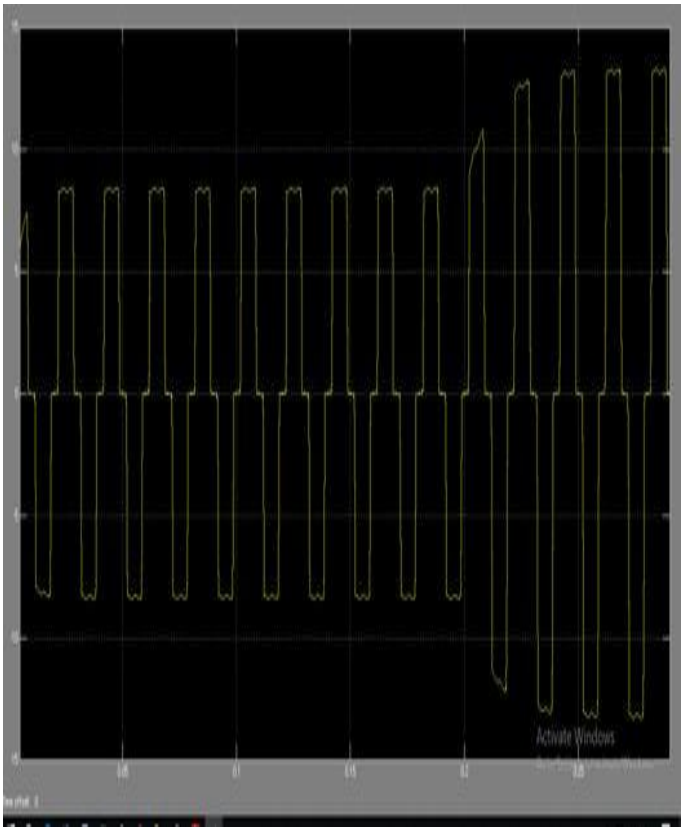
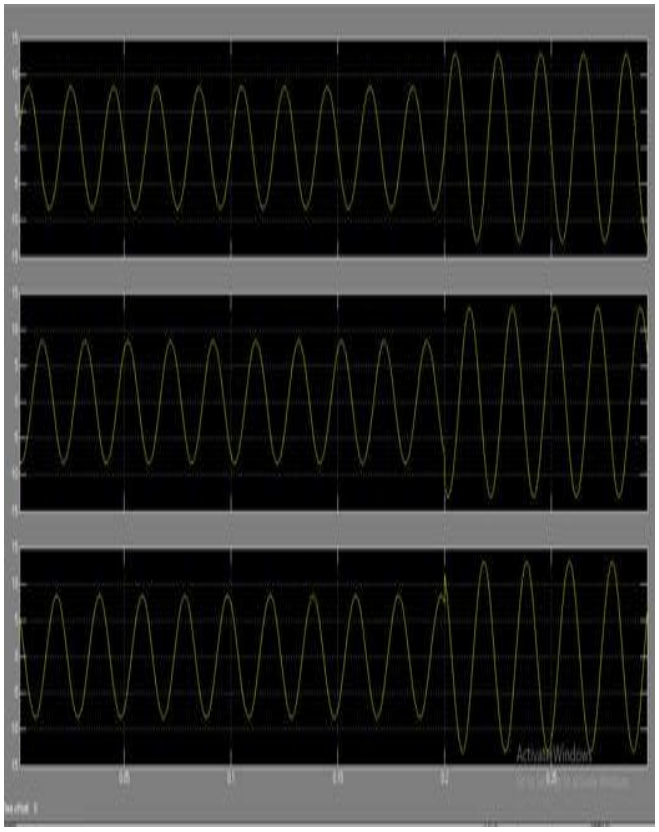


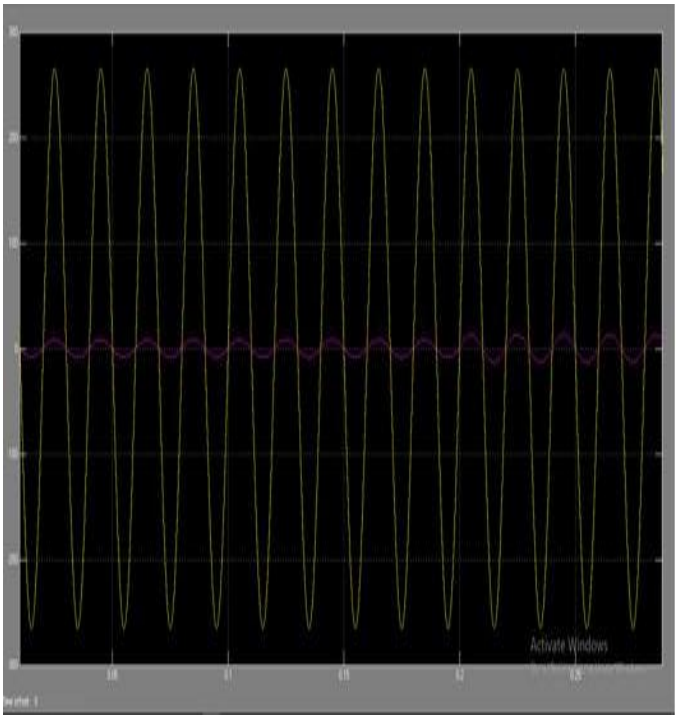
Figure 2: Upqc subsystem model

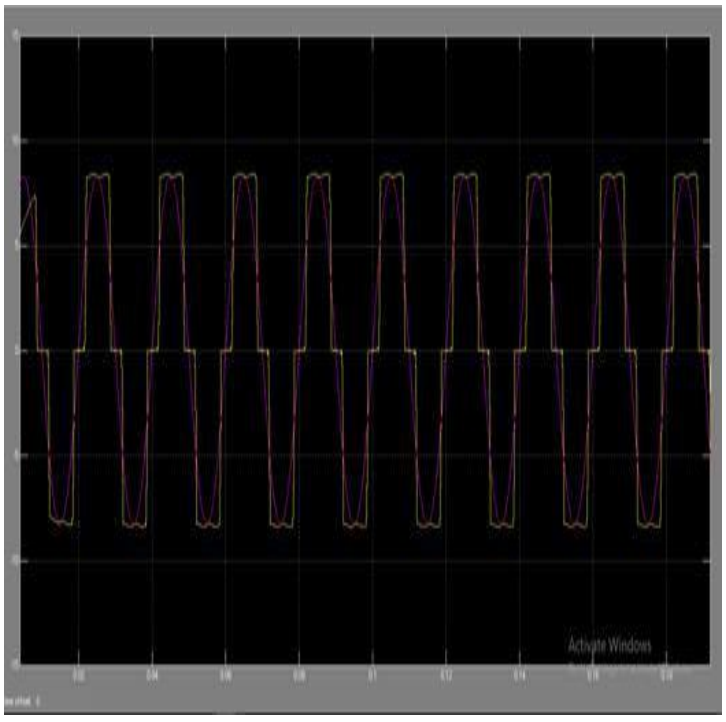
IV.EXPERIMENTALRESULTS

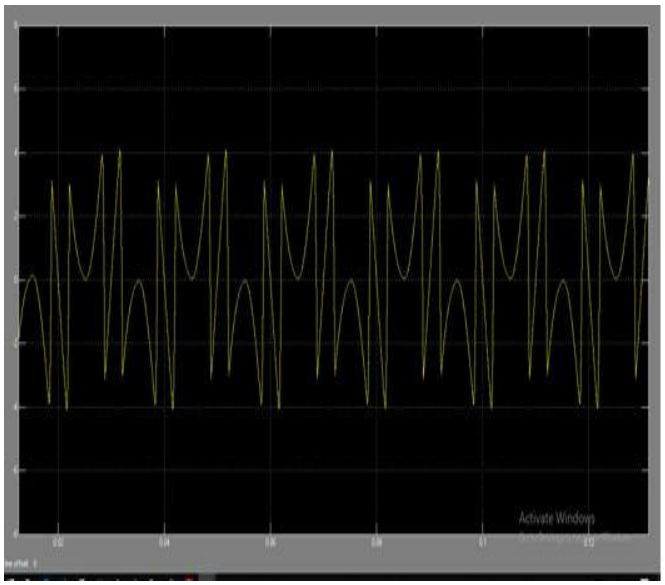
Proposed UPQC

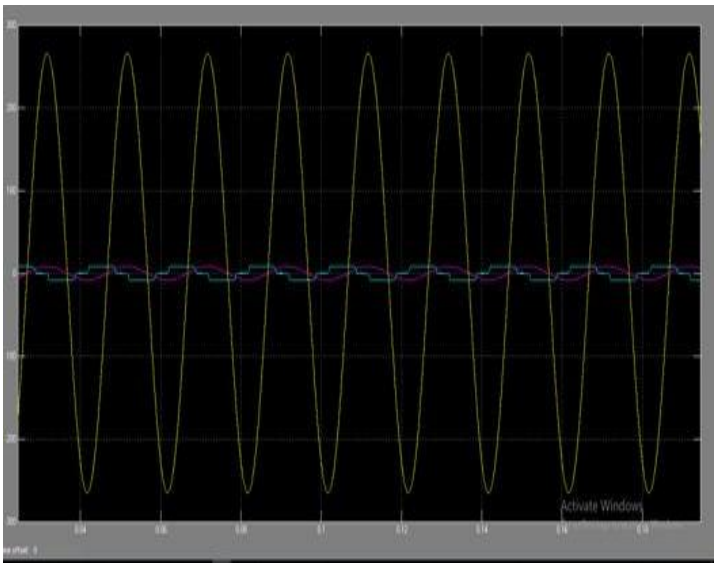


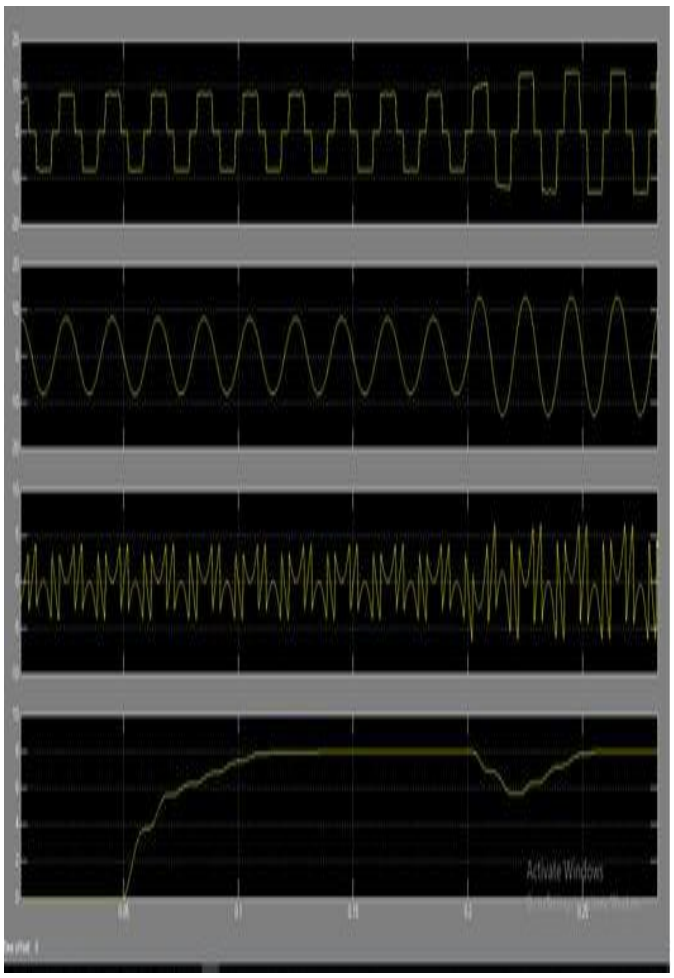


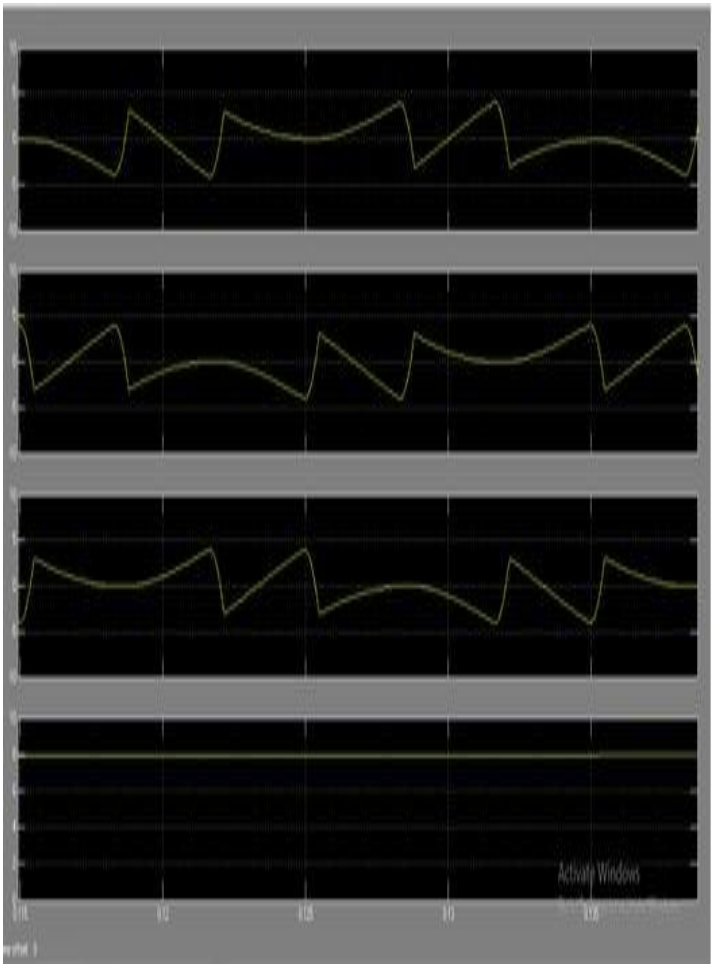












Extension MC-UPQC

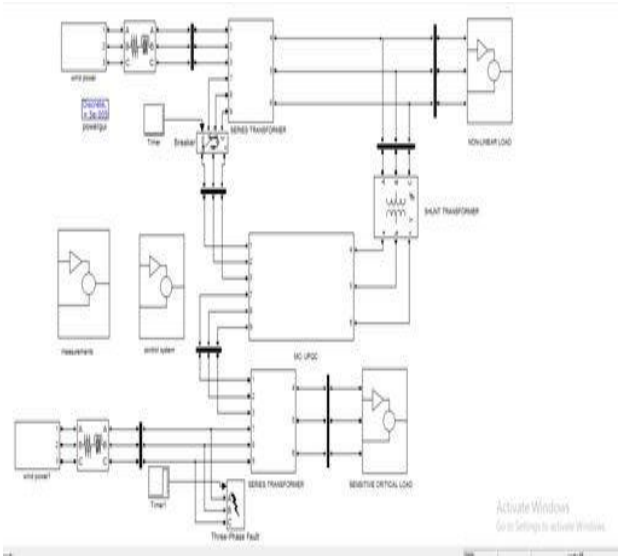


Figure 3: mc-upqc extension model

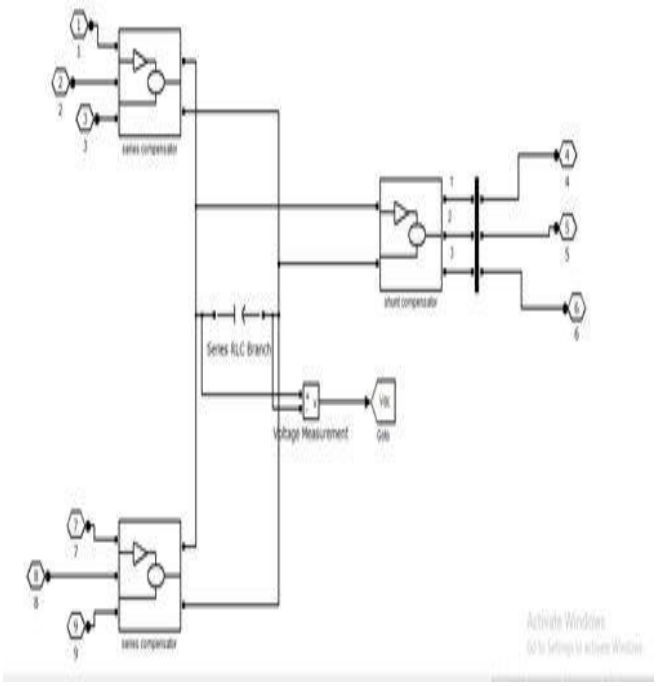


Figure 4: Multi converter upqc subsystem

III. CONCLUSION AND FUTURESCOPE

In this research work, the multi converter unified power quality conditioner is proposed for power sharing compensation of voltage and current imperfections. Another arrangement of an UPQC known as the MC-UPQC (multi- converter unified power quality conditioner) is exhibited. The framework is enhanced by including a series VSC in an adjoining feeder. In the previous configuration, the regulation of voltage in one of the feeders is implemented by the shunt- VSC. In any case, since the impedance of source is low, a high measure of current would be expected to enhance the bus voltage if there should arise an occurrence of a voltage swell/sags that isn't feasible. It additionally has low dynamic performance that the dc-link capacitor voltage isn't regulated. Whereas in the proposed design, MC-UPQC (unified power quality conditioning system), fit for synchronous compensation for current and voltage in multi-feeder/multi-bus frameworks. Finally, this work analyses the performance of existing and proposed configuration and validate the simulation results. Experimental results demonstrate that proposed technique is more efficient as compared to the existing techniques .In future, this work can be extended to multibus /multifeeder systems by adding more series VSCs. Moreover, artificial techniques like ANN and fuzzy can be used to obtain more optimized results.

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