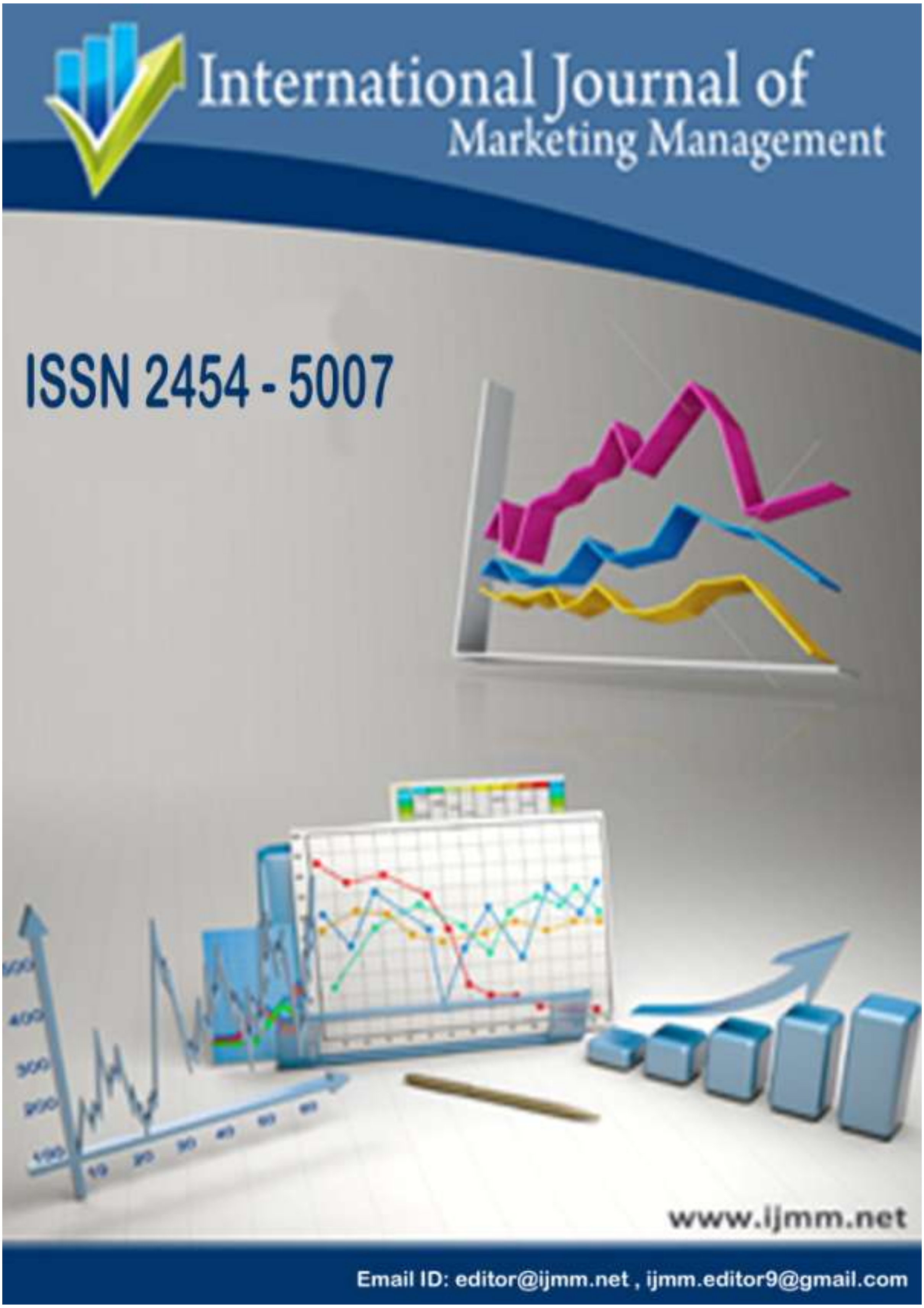
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INTERLINE DYNAMIC VOLTAGE RESTORER FOR CASCADED H- BRIDGE INVERTER WITH FUZZY LOGIC

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ABSTRACT— In this study, we suggest a novel approach for reducing harmonics under distortion voltages, namely a fuzzy logic controller. The real grid code required for connecting to the grid. voltage sags of lengthy durations, as well as harmonics in distributed generating systems. New sag mitigation technology, the interline dynamic voltage restorer (IDVR), consists of multiple dynamic voltage restorers (DVRs) linked together by a single DC connection, each of which is coupled to a distribution feeder in series. Power may be shifted from one feeder to another during the sag period, preventing long-term voltage sags. IDVR compensation capacity, on the other hand, is heavily dependent on the load power factor, and a greater load power factor results in poorer IDVR performance. A novel solution is provided in this study to overcome this constraint, which permits decreasing the load power factor during sag situations and therefore increasing the compensating capacity by employing fuzzy logic. Two cascaded H-bridge multilevel converters are used to inject ac voltage with reduced total harmonic distortion and avoid the need for low-frequency isolation transformers on one side of the proposed IDVR. Simulations in the Matlab/Simulink environment are used to verify the proposed configuration's validity.

Index Terms— Fuzzy logic, cascaded H-bridge, interline dynamic voltage restorer (IDVR), minimal energy, power quality (PQ), voltage sag.

I.INTRODUCTION

This paper proposes an Interline Dynamic Voltage Restorer (IDVR) based on a Cascaded H-Bridge Multilevel Inverter (MLI) for compensating voltage sag/swell and suppressing harmonics in distribution networks. Odd-order harmonics must be reduced in the Distribution System to enhance the performance of power distribution to sensitive loads. However, with IDVR, the harmonics created by Voltage Source Converters (VSC) with Active Filters are not totally reduced (AF). as an alternative to VSC, , motors). This, in turn, decreases the displacement factor (DF) and increases the electrical demand.When operating at low DF, you run the risk of reducing system efficiency owing to increased copper loss, poorer usage of power system components, and problems with voltage control, all of which may lead to higher power delivery costs. To enhance DF, a variety of practical methods are often used. Capacitor banks with optimised size and position have been included in the DF upgrade. Capacities may be added in radial distribution feeders to enhance their

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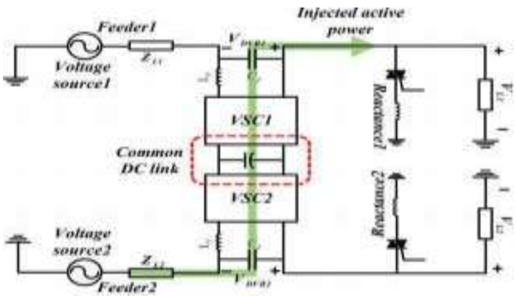
topology based IDVR is proposed to compensate

voltage profile and minimise overall energy loss, which is displayed. Distribution networks utilise a variety of approaches to reduce power losses. When it comes to reducing system losses, the notion of feeder reconfiguration is used. It is claimed that a combined system for harmonic suppression and reactive power compensation may enhance the DF as well as the power factor.To increase DF performance, Statcoms may be employed. Active and reactive power exchanges between the STATCOM and distribution system may be effectively controlled by adjusting the phase and amplitude of the STATCOM output voltages as needed. The gadget can absorb or create controlled active and reactive powers in this setup. A STATCOM provides a number of advantages, including a rapid reaction time, a small footprint, and high stability margins. [1] Capacitive reactive power provided by the STATCOM for DF improvement is gradually replacing traditional naturally commutated reactive power controllers and static VAR compensators. STATCOM's dc-link voltage rises as the STATCOM's reactive power



increases (the higher the voltage requirements of the semiconductor devices). [2] The digital video recorder (DVR) is one of the devices.The most popular and most successful ways to safeguard important loads against voltage sags.. Using a DVR, which is a power electronic device, the distribution feeder voltage sags may be compensated for by injecting three-phase voltage in series and synchronism. Aside from that, it may be utilised to improve the resilience of wind turbine systems by enhancing their fault ride-through capabilities. It is critical to identify the problem as quickly as possible in order to restore electricity.DVR detection techniques that are quick and DVR control systems that are successful are also presented. Due to its straightforward digital implementation and better dc-link consumption, space vector modulation (SVM) is the preferred modulation algorithm in a DVR. By injecting active and/or reactive power into a distribution feeder, load voltage restoration may be accomplished. Capacity of energy storage and correction techniques determine the DVR's active power capabilities. Due to high power considerations, it will be demonstrated later that the DVR's performance decreases. DVRs with capacitive dc links, such as IDVRs, cannot correct voltage sags on feeders with ohmic loads, for example. [3] This study proposes a topology that not only enhances IDVR sag compensation capacity at high power factors, but also improves the compensator's ability to attenuate extremely deep sags at moderate power factors, thereby overcoming this constraint. In order to lower the power factor during the sag condition, a reactance is added in parallel with each load.

IDVR's OPERATING POLICY

The IDVR in Fig. 1 is made up of two voltage-source converters (VSC) connected in a back-to-back fashion through a shared dc connection. It is feasible to prevent deeper and longer voltage sags with this design and to move active power from one feeder to another during a sag condition Fig (11). A voltage sag in feeder1 may be compensated by DVR1 if, for example, this happens. DVR1's injected active power would be, if and are the active powers of sourcePs1 and loadPl1.

Fig1: Power circuit schematic of the IDVR with active power-exchanging capability

In a VFD or phase converter, for example, a DC connection exists between a rectifier and an inverter. High-voltage DC is converted from the utility connection on the other end. On the other hand, the DC power is converted into a new AC waveform. When the input and output stages are connected, it is a link. The decoupling capacitor in the DC connection is sometimes referred to as a "DC link." This, I believe, is the subject of your inquiry. The output side of the switching network creates huge transients at the switching frequency.

The DC link capacitor prevents these transients from re-radiating back to the input of the amplifier. [4] A short may also be avoided by ensuring that the switching network does not oscillate or activate at the wrong time. In addition, when the input waveform is close to zero, the capacitor acts as a power source by storing energy when the input is not multiple-phase. Two back-to-back voltage source converters (VSC) with a shared dc connection form a basic IDVR as illustrated in Figure (1). [5] As voltage drops, this design allows for active power to be transferred from one feeder to another, helping to prevent and even reduce more severe and long-lasting power outages. Fig(11). DVR1 begins to correct for voltage sag in feeder1 when it happens, for example. The load power factor must be lowered during the sag phase in order to solve this issue and enhance IDVR performance.

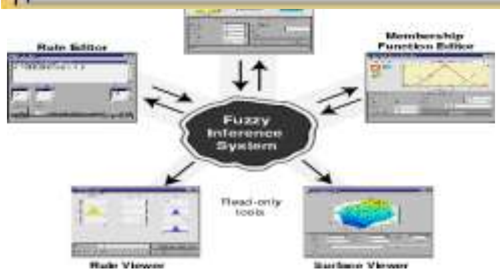
II**. FLUZZY THOUGHTS**

Fuzzy logic has seen a dramatic rise in the number and range of applications in recent years. Applications include anything from consumer electronics like cameras and camcorders to home appliances like washing machines and microwave ovens to industrial processes like process control and medical instruments. To get a grasp on whyuse of fuzzy logic has grown, you must first understand what is meant by fuzzy logic.

Fig. 2 The Primary GUI Tools Of The Fuzzy Logic Toolbox

It is the FIS Editor's job to take care of all of the system's high-level issues: Exactly how much information about the input and output variables do you need? Why don't you tell me? The number of inputs is unrestricted with the Fuzzy Logic Toolbox. However, your machine's RAM may place a restriction on the amount of inputs you may use. The other GUI tools may also have difficulty analysing the FIS if the number of inputs or membership functions is too huge.Using the Membership Function Editor, you may design the membership functions associated with any variable. The Rule Editor is used to make changes to the system's set of rules.The Editor of the FIS

The talk that follows will guide you through the process of starting from scratch with a brand new



fuzzy inference system. If you're pressed for time, just type fuzzy tipper into your browser to load the pre-built system and get started right away. FIS Editor will be launched and the FIS linked with the file tipper.fis will be loaded. If you load the pre-built system, on the other hand, you won't be creating rules or defining memberships.

Fig.3 . The FIS Editor

By saving to the workspace with a new name, you also rename the entire system. Your window will look like as shown in Fig.

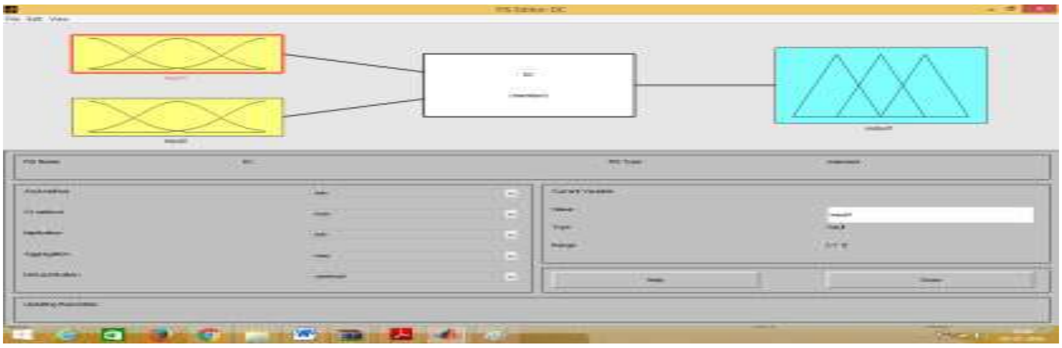


Fig..4 .The Updated FIS Editor

A. THE MEMBERSHIP FUNCTION EDITOR: THE RULE EDITOR:

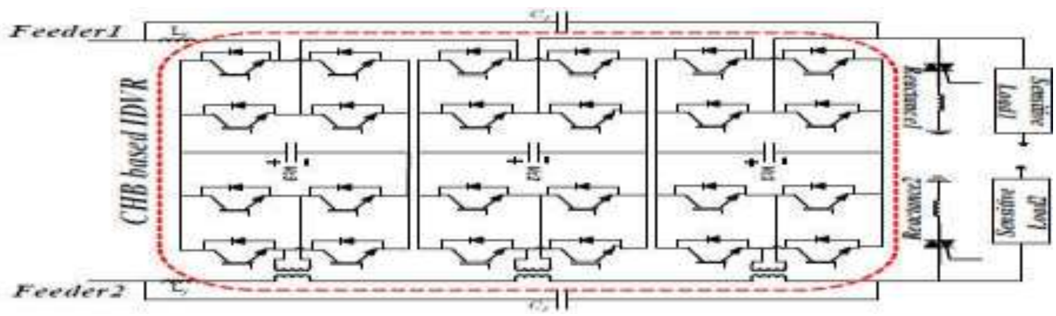
The Rule Editor

	NB	NM	NS	ZE	PS	PM	PB
NB	NB	NB	NB	NB	NM	NS	ZE
NM	NB	NB	NB	NM	NS	ZE	PS
NS	NB	NB	NM	NS	ZE	PS	PM
ZE	NB	NM	NS	ZE	PS	PM	PB
PS	NM	NS	ZE	PS	PM	PB	PB
PM	NS	ZE	PS	PM	PB	PB	PB
PB	ZE	PS	PM	PB	PB	PB	PB

II. **PROJECT DISCRIPTION AND CONTROL DESIGN**

A.CHB BASED IDVR

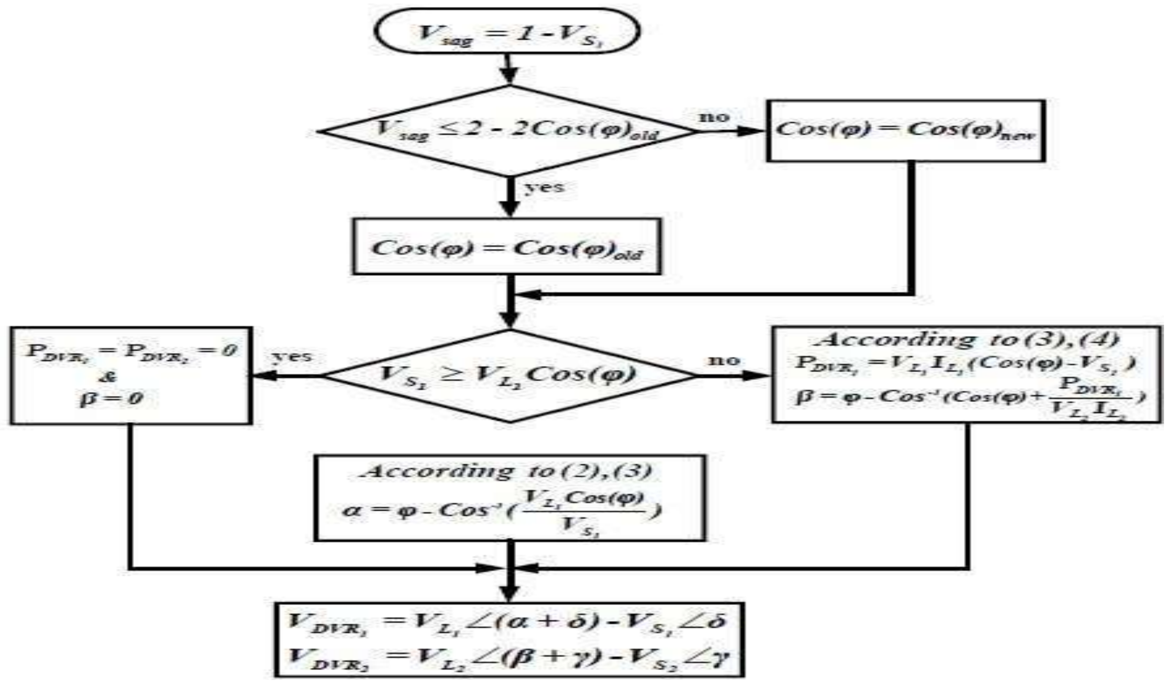
Voltage source converters based on two-level converters are the most often discussed topic in DVR and IDVR literature. While a CHB based multilayer converter is a more appealing choice for higher voltage and higher power applications, its implementation in an IDVR is shown here.Cascaded H-bridge converters are a more attractive multilevel topology for IDVR because of its modular construction, their ability to attain medium output voltage levels using just conventional low voltage mature technology components, and their superior dependability. Low frequency modulation approaches and fault-tolerant algorithms can be readily implemented in CHB-based IDVRs [6]-[7].For each voltage level to be synthesised in a CHB converter, a separate DC connection is required.



However, the IDVR structure, as illustrated in fig, is back-to-back (7).

Two CHB converters and low frequency isolation transformers on one side allow for different DC lines to be created. Because transformer isolation is no longer necessary on one side, this design results in smaller, lighter, and less expensive transformers. Depending on the voltage rating of the power switches, the number of H-bridge cells in a CHB converter is determined. CHB-based IDVR for simulation and experimentation is shown in this video tutorial. There are no limitations to the control method presented in this research, even though it is tested on a 7-level back-to-back converter in this work. Multilevel modulation methods will be used by the CHB converter to synthesise voltage references produced by the control system. Keeping DC link capacitor voltages in balance is the sole problem that has to be dealt with in [8] and [9].In the utilized 7-level CHB converter, the DC link voltage and current rating of each cell can be specified with to (12) and (13). (17). A cell's current and DC link voltage must both be larger than one if the DC link utilisation factor is, say, 0.85.

B**. APPLICATION OF CONTROL STRATEGIES**



In this study, the voltage sag compensation is done using the minimal energy technique. Control system block diagram is provided in based on this concept. First, the magnitude of voltage sag is computed and compared to a predetermined threshold. The shunt reactances are paralleled to the loads to reduce the load power factor if the sag amplitude exceeds this amount. Next, the DVR voltages are calculated based on the source's equivalent power factor. Fast and precise estimate systems are needed to calculate the waveforms' phase and magnitude in this control system. One of the most often used estimating approaches is the fast fourieSr transform (FFT), which has been shown to have a pretty high degree of accuracy [11]. The FFT technique is employed in this study to estimate. The control system is then able to estimate these signals.

Fig. 8 Flowchart of the IDVR control system.

III. SIMULATION RESULTS

Load current DVR1 Figs. Investigating the IDVR performance when the proposed method is applied for a sag with depth of 0.4p.u.

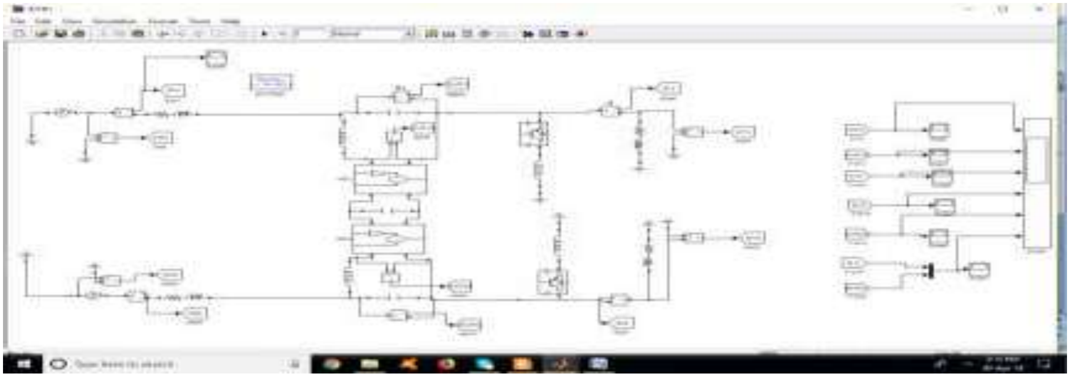
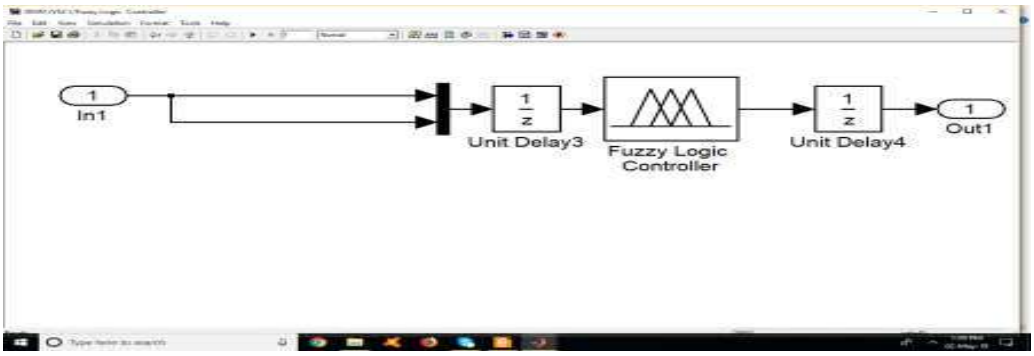


Fig9.Simulation model



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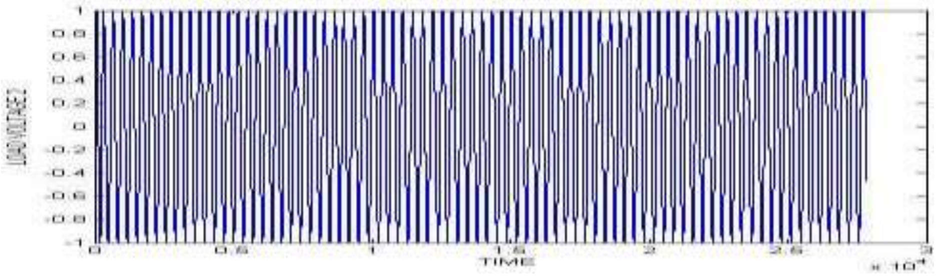

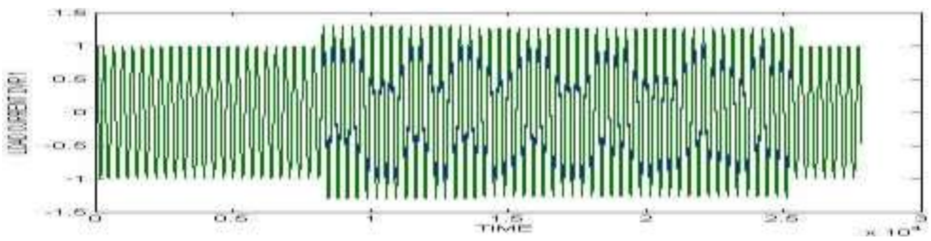

CONCLUSION

As part of this research, a new configuration has been presented that not only enhances the IDVR's ability to adjust for high power factors, but also improves the IDVR's ability to adapt for low power factors. By lowering the load power factor during a sag state, these benefits were realised. When a voltage sag is recognised, reactances are switched into the circuit to reduce the load power factors to increase IDVR performance and reduce power consumption. Finally, the suggested configuration and control strategy was shown to be successful in simulation and in real-world use of the CHB-based IDVR.

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