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Modeling of Photovoltaic Fed Multilevel UPQC for Power Quality Using MATLAB

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ABSTRACT

In recent trends Renewable Electric Source fed flexible ac transmission devices makes tremendous changes in power quality characteristics in conventional power system configuration. This paper proposes RES fed multilevel Unified Power Flow Controller for PQ characteristics improvement. In this circuit configuration a novel clamped multilevel architecture is used for voltage source converters modeling which is located in series and shunt connections of UPQC. In spite of conventional capacitor fed VSC here photovoltaic fed multilevel configuration is used to improve PQ characteristics in contemporary power configuration.
Keywords: Multilevel UPQC, multilevel VSC. Power quality, PV System.

I. INTRODUCTION

Due to the accelerated range of nonlinear hundreds in the strength gadget we need and green and fee effective answer to improve the electricity high-quality. as the conventional passive power filters fails at resonant condition we can adopt the active strength filters to improve the transients as well as consistent nation stability of our system [1], [2], [3]. To do this we want voltage and cutting-edge assets inverters. we can reduce the cost of our machine by a proper layout and selection of inverter topology from the wide range of available options [5]. The cascaded multilevel inverter is a value powerful answer [11] and it reduces harmonics in the system [4], [10]. The UPQC affords better traits than as compared to individual collection and shunt energetic strength filters [6], [7], [8], [9]. To operation of the proposed UPQC became confirmed thru simulation with MATLAB/ Simulink software program.

Series and shunt lively electricity filters are related returned to lower back by using the dc hyperlink capacitior to form an UPQC. Fig. 3. Suggests the circuit connection of UPQC. An active power filter is implemented when orders of harmonic currents are varying. One case is a variable velocity force. Lively filters use lively additives together with MOSFET, IGBT and many others. to inject negative harmonics to into the community efficaciously changing a portion of the distorted contemporary wave coming from the weight. active filters can be classified based at the connection scheme as: shunt energetic filter out, collection lively filter and UPQC.

An active electricity filter linked in parallel to the burden is referred to as shunt energetic strength filter out. This injects bad harmonic currents into the line to cancel the harmonics generated with the aid of the nonlinear load. Fig. 1 illustrates the idea of the harmonic modern cancellation so that the current being provided from the supply is sinusoidal.

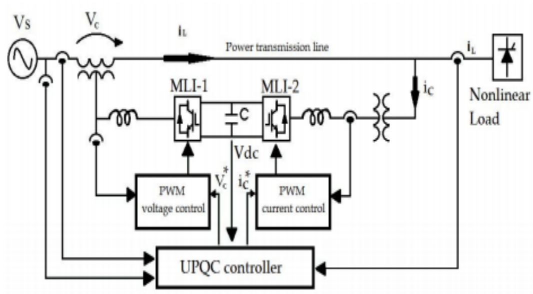

Figure 1. conventional UPQC under steady state

An active energy filter related in collection to the burden is thought as series energetic energy filter. This works as isolator, rather than generators of harmonics. Series active electricity filters acts as controllable voltage assets. A voltage source inverter is used as the collection lively electricity filter out. that is managed so as to draw or inject a compensating voltage from or to the supply, such that it cancels voltage harmonics on the load side. Parent illustrates the idea of the series active strength clears out.

II. MULTI LEVEL VSC CONFIGURATION

Multi level inverters use components of low rating to serve medium rated applications to reduce the overal cost. The performance of an inverter with any switching strategies can be related to the harmonics contents of its output voltage. Based on inverter topology they are divided into three types:

1. Diode clamped multilevel inverter.
2. Flying capacitor multilevel inverter.
3. Cascaded multilevel inverter.

The diode-clamped inverter is also known as the neutral-point clamped inverter (NPC) which was introduced by Nabae et al (1981). The diode-clamped inverter consists of two pairs of series switches (upper and lower) in parallel with two series capacitors where the anode of the upper diode is connected to the midpoint (neutral) of the capacitors and its cathode to the midpoint of the upper pair of switches; the cathode of the lower diode is connected to the midpoint of the capacitors and divides the main DC voltage into smaller voltages, which is shown in Figure The advantages for the diode-clamped inverter are,

1. A large number of levels 'n' yields a small harmonic distortion.
2. All of the phases share a common dc bus
3. Reactive power flow can be controlled.
4. High efficiency for fundamental switching frequency.
5. Relatively simple control methods.

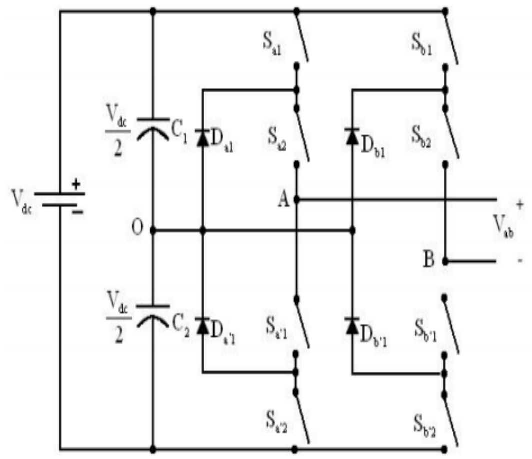

Figure 2. Diode clamped type configuration for multilevel VSC

III. PROPOSED CONTROLLER

In recent years, the number and variety of applications of fuzzy logic have increased significantly. The applications range from consumer products such as cameras, camcorders, washing machines, and microwave ovens to industrial process control, medical instrumentation, decision-support systems, and portfolio selection.

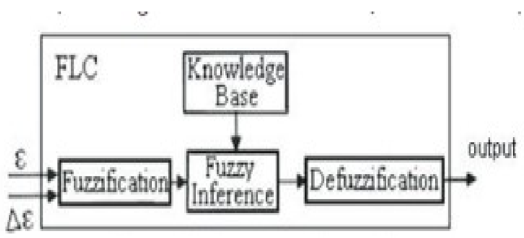

Figure 3. Basic fuzzy system

Fuzzy logic has two different meanings. In a narrow sense, fuzzy logic is a logical system, which is an extension of multivalve logic. However, in a wider sense fuzzy logic (FL) is almost synonymous with the theory of fuzzy sets, a theory which relates to classes of objects with un-sharp boundaries in which membership is a matter of degree. In this perspective, fuzzy logic in its narrow sense is a branch of fl. Even in its more narrow definition,

The basic concept in FL, which plays a central role in most of its applications, is that of a fuzzy if-then rule or, simply, fuzzy rule. Although rule-based systems have a long history of use in Artificial Intelligence (AI), what is missing in such systems is a mechanism for dealing with fuzzy consequents and fuzzy antecedents. In fuzzy logic, this mechanism is provided by the calculus of fuzzy rules. The calculus of fuzzy rules serves as a basis for what might be called the Fuzzy Dependency and Command Language (FDCL). Although FDCL is not used explicitly in the toolbox, it is effectively one of its principal constituents. In most of the applications of fuzzy logic, a fuzzy logic solution is, in reality, a translation of a human solution into FDCL.

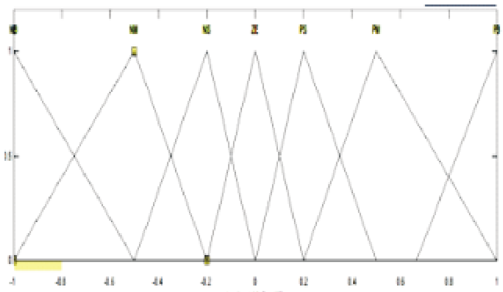

Figure 4. membership function of error

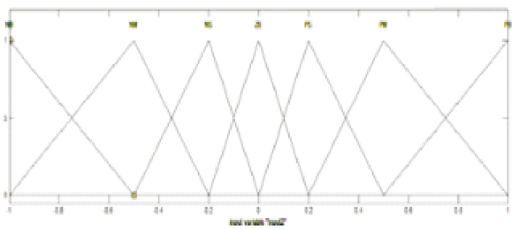

Figure 5. membership function of change in error

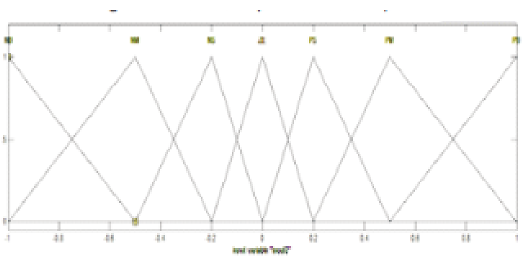

Figure 6. membership function of controller output

A trend that is growing in visibility relates to the use of fuzzy logic in combination with neuro computing and genetic algorithms. More generally, fuzzy logic, neuro-computing, and genetic algorithms may be viewed as the principal constituents of what might be called soft computing. Unlike the traditional, hard computing, soft computing accommodates the imprecision of the real world.

ε / Δε	NB	NM	NS	ZE	PS	PM	PB
NB	NB	NB	NB	NB	NM	NS	ZE
NM	NB	NB	NM	NM	NS	ZE	PS
NS	NB	NM	NS	NS	ZE	PS	PM
ZE	NB	NM	NS	ZE	PS	PM	PB
PS	NM	NS	ZE	PS	PS	PM	PB
PM	NS	ZE	PS	PM	PM	PB	PB
PB	ZE	PS	PM	PB	PB	PB	PB

Figure 6. fuzzy rules used in configuration

IV. SIMULATION ANALYSIS

The total circuit is modeled and simulated in MATLAB 2009A under power graphical user interfacing environment and circuit is supported for fast fourier transformation analysis.in order to implement circuit configuration simscape-simpower system components are used and model configuration and corresponding results are given below as

The objective is to verify the current harmonic compensation effectiveness of the proposed control scheme under different operating conditions. A six pulse rectifier was used as a non-linear load. In the simulated results shown in phase to neutral source voltage at t=0 to t=0.8. shows the source currents at t=0 to t=0.8.

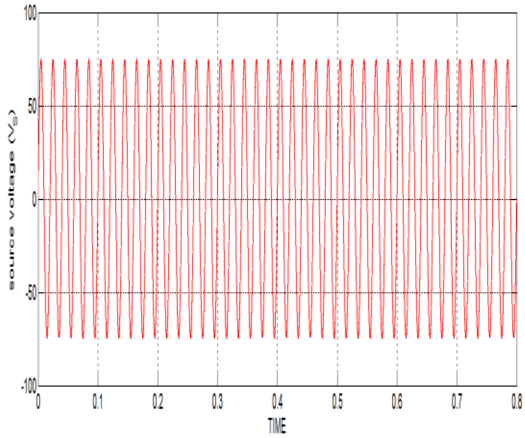

Figure 7. Phase to Neutral Source Voltage

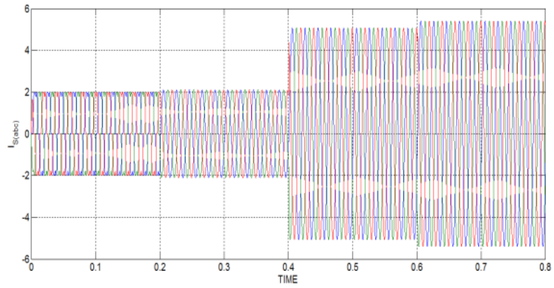

Figure 8. Source Currents

As the load is non-linear it draws a non-sinusoidal current, without active power filter compensation shown And the load current at t=0 to t=0.4 is shown The active filter starts to compensate at t =0.2. At this time, the active power filter injects an output current i_{ou} to compensate current harmonic components, current unbalanced, and neutral current simultaneously. During compensation, the system currents (i_s) show is a sinusoidal waveform, with low total harmonic distortion.

At t =0.4, a three-phase balanced load step change is generated shown. The compensated system currents, shown remain sinusoidal despite the change in the load current magnitude.

Finally, at t =0.6, a single-phase load step change is introduced in phase u which is equivalent to an 11% current imbalance, shown. As expected on the load side, a neutral current flow through the neutral conductor (i_{Ln}), shown, but on the source side, no neutral current is observed (i_{sn}) shown.

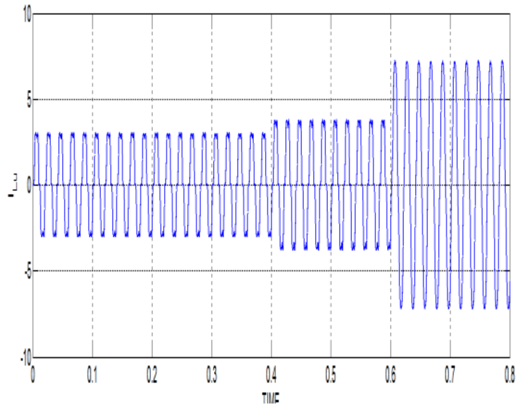

Figure 9. Load Current

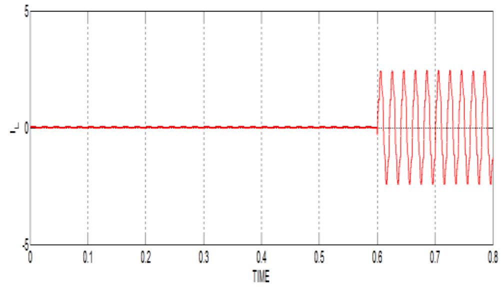

Figure 10. Load Neutral Current

V. CONCLUSION

This paper proposes RES fed multilevel Unified Power Flow Controller for PQ characteristics improvement. In this circuit configuration a novel clamped multilevel architecture is used for voltage source converters modeling which is located in series and shunt connections of UPQC. In spite of conventional capacitor fed VSC here photovoltaic fed multilevel configuration is used to improve PQ characteristics in contemporary power configuration.Total circuit is modeled and simulated under dynamic load condition and proposed circuit configuration shown efficient power quality characteristics than compare to the proposed system response.

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