Design and Implementation of Multilevel UPFC with Fuzzy Logic Controller for the Solution of Transmission Congestion Related Issues

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***Abstract*— Due to the rapid development in power electronic devices and their control schemes flexible ac transmission devices makes tremendous changes in power systems network related issues in conventional power system configuration. This paper proposes multilevel Unified Power Flow Controller for the solution of Transmission Congestion control. 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 UPFC. In spite of conventional methods VSC based multi level UPFC configuration is used to improve Voltage Profile characteristics in contemporary power configuration.**

***Keywords*— Multilevel UPFC, multilevel VSC. Voltage profile, congestion control**

I. INTRODUCTION

Due to the accelerated vary of nonlinear a whole lot within the strength contrivance we'd like and inexperienced and fee effective answer to boost the electricity high-quality. Because the standard passive power filters fails at resonant condition we are able to adopt the active strength filters to boost the transient's moreover as consistent nation stability of our system [1], [2], [3]. To try and do this we would like voltage and latest assets inverters. We are able to scale back the value of our machine by a correct layout and choice of electrical converter topology from the big selection of accessible choices [5]. The cascaded structure electrical converter could be a worth powerful answer [11] and it reduces harmonics within the system [4], [10]. The UPQC affords higher traits than as compared to individual assortment and shunt energetic strength filters [6], [7], [8], [9]. To operation of the planned UPQC became confirmed via simulation with MATLAB/ Simulink software system program.

Series associated shunt spirited electricity filters are connected came back to lower back by exploitation the dc link capacitor to make an UPQC. Fig. 3.Suggested circuit affiliation of UPFC. A full of life power filter is enforced once orders of harmonic currents are variable. One case could be a variable rate force. Spirited filters use spirited additives alongside MOSFET, IGBT and plenty of others. To inject negative harmonics to into the community effectively dynamic some of the distorted modern wave coming back from the burden. Active filters may be classified primarily based at the affiliation theme as: shunt energetic filter, assortment spirited filter and UPQC.

An active electricity filter connected in parallel to the burden is observed as shunt energetic strength filter. This injects dangerous harmonic currents into the road to cancel the harmonics generated with the help of the nonlinear load. Fig. one illustrates the thought of the harmonic trendy cancellation in order that the present being provided from the provision is curving

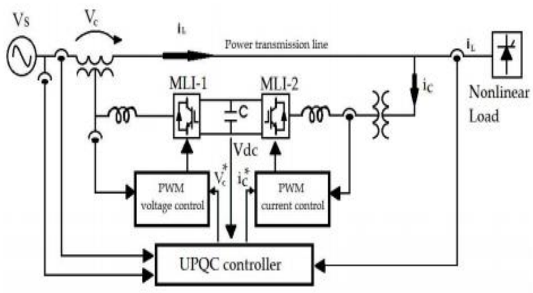

Fig 1 conventional UPQC under steady state

An active energy filter connected in assortment to the burden is assumed as series energetic energy filters. This works as isolator, instead of generators of harmonics. Series active electricity filters acts as governable voltage assets. A voltage supply electrical converter is employed because the assortment spirited electricity strain. That's managed thus on draw or inject a compensating voltage from or to the availability, specified it cancels voltage harmonics on the load facet. Parent illustrates the concept of the series active strength clears out.

II MULTI LEVEL VSC CONFIGURATION

Multi level inverters use parts of low rating to serve medium rated applications to scale back the overall price. The performance of associate electrical converter with any switch methods will be associated with the harmonics contents of its output voltage. Supported electrical converter topology they're divided into 3 types:

1. Diode clamped multilevel inverter.

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2. Flying capacitor multilevel inverter.

3. Cascaded multilevel inverter.

The diode-clamped electrical converter is additionally referred to as the neutral-point clamped electrical converter (NPC) that was introduced by Nabae et al (1981). The diode-clamped electrical converter consists of 2 trys of series switches (upper and lower) in parallel with 2 series capacitors wherever the anode of the higher diode is connected to the point (neutral) of the capacitors and its cathode to the point of the higher pair of switches; the cathode of the lower diode is connected to the point of the capacitors and divides the most DC voltage into smaller voltages, that is shown in Figure the benefits for the diode-clamped electrical converter square measure,

(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.

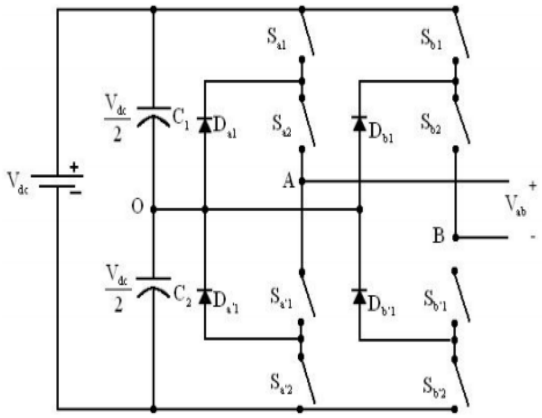

Fig 2 Diode clamped type configuration for multilevel VSC

III PROPOSED CONTROLLER

In recent years, the quantity and form of applications of formal logic have hyperbolic considerably. The applications vary from client merchandise like cameras, camcorders, laundry machines, and microwave ovens to process management, medical instrumentation, decision-support systems, and portfolio choice.

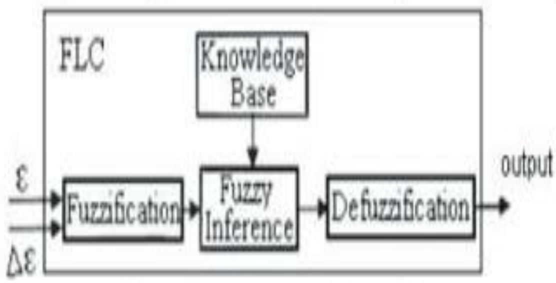

Fig 3 Basic fuzzy system

Fuzzy logic has 2 completely different meanings. In a very slender sense, mathematical logic may be a system of rules that is associate degree extension of multivalve logic. However, in a very wider sense mathematical logic (FL) is nearly substitutable with the idea of fuzzy sets, a theory that relates to categories of objects with un-sharp boundaries within which membership may be a matter of degree. During this perspective, mathematical logic in its slender sense may be a branch of Everglade State. Even in its additional slender definition,

The basic conception in Everglade State, that plays a central role in most of its applications, is that of a fuzzy if-then rule or, simply, fuzzy rule. Though rule-based systems have an extended history of use in computer science (AI), what's missing in such systems may be a mechanism for coping with fuzzy consequents and fuzzy antecedents. In mathematical logic, this mechanism is provided by pure mathematics of fuzzy rules. Pure mathematics of fuzzy rules is a basis for what can be referred to as the Fuzzy Dependency and source language (FDCL). Though FDCL isn't used expressly within the tool case, it's effectively one in every of its principal constituents. In most of the applications of mathematical logic, a mathematical logic answer is, in reality, a translation of a person's answer into FDCL.

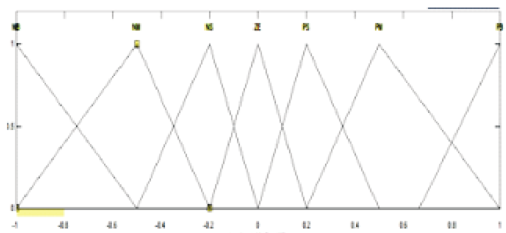

Fig 4 membership function of error

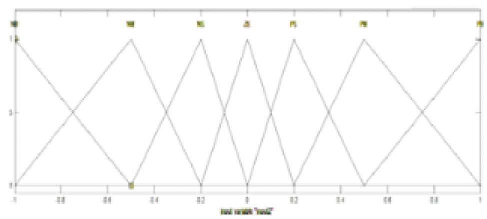

Fig 5 membership function of change in error

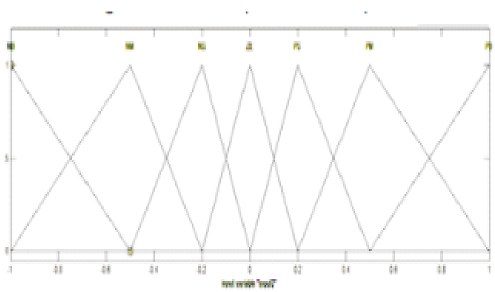

Fig 6 membership function of controller output

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A trend that's growing in visibility relates to the utilization of mathematical logic together with neuro computing and genetic algorithms. Additional usually, mathematical logic, neuro-computing, and genetic algorithms is also viewed because the principal constituents of what may be referred to as soft computing.

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

Fig 6 fuzzy rules used in configuration

IV SIMULATION ANALYSIS

The total circuit is sculptured and simulated in MATLAB 2009A beneath power graphical user interfacing setting AND circuit is supported for quick Fourier transformation analysis. in order to implement circuit configuration simscape-simpower system parts area unit used and model configuration and corresponding results area unit given below as The objective is to verify this harmonic compensation effectiveness of the projected management theme beneath completely different in operation conditions. A six pulse rectifier was used as a non-linear load. Within the simulated results shown in part to neutral supply voltage at t=0 to t=0.8. Shows the supply currents at t=0 to t=0.8

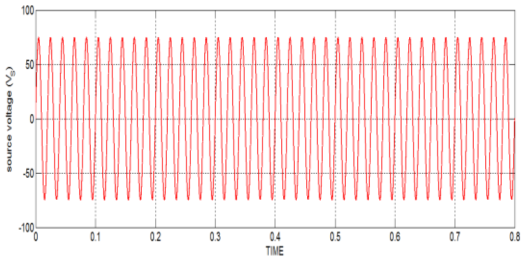

Fig. 7 Phase to Neutral Source Voltage

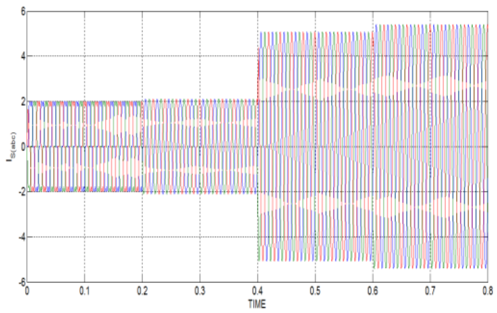

Fig. 8 Source Currents

As the load is non-linear it attracts a non-sinusoidal current, while not active power filter compensation shown and therefore the load current at t=0 to t=0.4 is shown the active filter starts to compensate at t =0.2. At now, the active power filter injects associate degree output current note of hand to compensate current harmonic parts, current unbalanced, and neutral current at the same time. Throughout compensation, the system currents (is) show could be a curved wave shape, with low total harmonic distortion.

At t =0.4, a three-phase balanced load step modification is generated shown. The stipendiary system currents, shown stay curved despite the modification within the load current magnitude.
Finally, at t =0.6, a single-phase load step modification is introduced in part u that is love associate degree Martinmas current imbalance, shown. Evidently on the load aspect, a neutral current flow through the neutral conductor (iLn), shown, however on the supply aspect, no neutral current is ascertained (isn) shown.

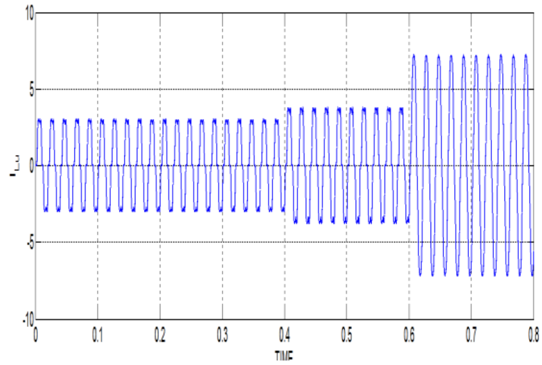

Fig. 9 Load Current

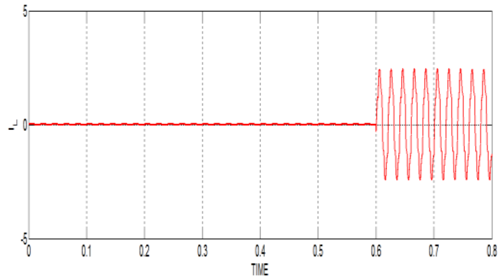

Fig. 10 Load Neutral Current

IV 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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