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POWER QUALITY IMPROVEMENT USING CASCADED H-BRIDGE MULTILEVEL INVERTER WITH D-STATCOM

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Abstract: **Contemporary energy techniques are highly complex and are designed as such to fulfil the growing demands of energy with better energy top quality and electrical energy top quality had obtained more attention in energy engineering in recent years. But due to faults in energy techniques many energy top quality problems including voltage sags and swells, harmonics and reactive energy burden etc,are taking place which are effecting the energy top quality and stability of energy source etc,. The Multilevel Inverter (MLI) centred DSTATCOM has the capability to reduce the energy top quality problems. Therefore, MLI centred DSTATCOM enhances the energy top quality by considerably reducing THD. This paper presents MATLAB/SIMULINK models of MLI centred DSTATCOM which can enhances the energy top quality for contemporary energy techniques.**

Keywords: **Power Quality, Power Quality Problems, DSTATCOM Multilevel Inverter and Matlab Simulink.**

I. INTRODUCTION

In present day's energy submission techniques is suffering from severe energy high quality issues. These energy high quality issues consist of high sensitive energy pressure, harmonic(s) currents, fill unbalance, extreme fairly neutral present etc. The measure of energy high quality relies upon the needs of the equipment that is being provided. What is excellent energy high quality for an auto may not be sufficient for a laptop or computer? Usually the term energy high quality relates to maintaining a sinusoidal waveform of bus currents at ranked volts and regularity [1]. Some remedies to these energy high quality troubles are revealed in the literary works. A group of remotes together called Custom Power Devices (CPD), such as the DSTATCOM (distribution static compensator), The DSTATCOM, is a shunt-connected device, which manages the ability high quality issues in the currents. Three stage four-wire submission techniques are used to supply single-phase low volts plenty.

The multilevel inverter has obtained much attention recently due to its advantages in reduced changing loss better electro-magnetic interface, higher volts capability, and reduced harmonics. Multilevel cascaded inverters have been also suggested for such programs as static Var generation, an interface with alternative energy, and for battery-based programs [3]. The inverter could be managed to either control the ability factor of the present attracted from the source or the bus volts of the electrical system where the inverter was linked. Several topologies for multilevel inverters have been suggested, the most popular being the diode-clamped, flying capacitor, and stream H-bridge components. The heart beat size modulation (PWM) cascaded multilevel inverter strategy decreases the total harmonic distortions and increases the fundamental outcome volts.

II. DSTATCOM

When the STATCOM is used for submission system is called Distribution-STATCOM (DSTATCOM) and its configurations is the same, or with small variations, targeted to a possible future enhancing of its opportunities in the submission system. The DSTATCOM shows high-speed control of delicate power to provide v backing, glimmer

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decrease. It operates on the design made up of a GTO or IGBT-based v obtained ripper linked to the power system via a multi-stage ripper transformer. The DSTATCOM protects the applying transferring or submission system from v sags and/or glimmer activated by quickly different delicate current requirement. In program programs, a DSTATCOM provides major or lagging delicate power to accomplish system balance during short-term circumstances. The DSTATCOM can also apply to vegetation to make up for v sag and glimmer activated by non-linear highly effective a lot, enabling such problem a lot to co-exist on the same fowl birdfeeder as more delicate a lot.

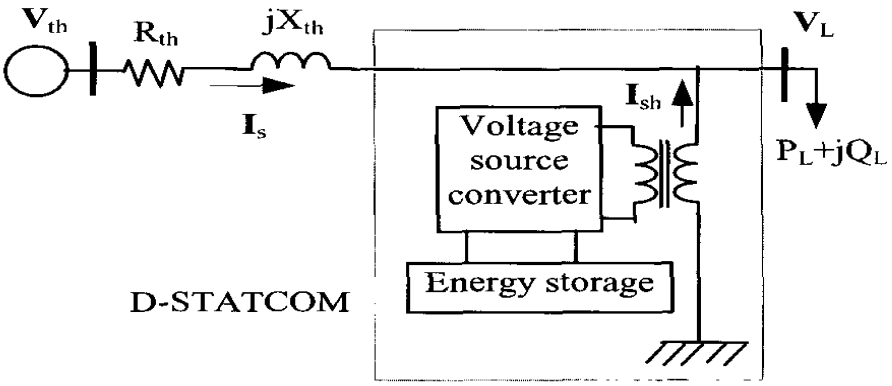

Fig.1. Schematic diagram of a STATCOM

A D-STATCOM (Distribution Fixed Compensator), which is schematically portrayed in Fig.1, created two- level Voltage source converter (VSC), a dc energy hard drive, a combining transformer linked in shunt to the submission system through a combining transformer. The VSC transforms the dc voltage across the hard drive into a set of three-phase ac outcome currents. These currents are in stage and along with the ac program through the reactance of the combining transformer. Appropriate modification of the stage and scale of the D- STATCOM outcome currents allows effective control of effective and sensitive energy transactions between the DSTATCOM and the ac program. Such settings allow the product to soak up or produce manageable effective and sensitive energy. The VSC linked in shunt with the ac program provides a multipurpose topology which can be used for up to three quite unique purposes: 1. Volts control and settlement of sensitive energy. 2. Modification of energy aspect and 3. Reduction of present harmonics. Here, such program is applied to provide ongoing voltage control using an ultimately managed converter.

III. MULTI LEVEL INVERTER

The multilevel ripper has attracted remarkable interest in the ability industry. The general structure of the multilevel ripper is to synthesize sinusoidal volts from several stages of currents, multilevel volts source converters are growing as a new breed of energy ripper options for great energy programs. These ripper topologies can produce high-quality volts waveforms with energy semiconductor changes working at regularity near the fundamental. Multilevel topologies are able to obtain better outcome great quality, while working at reduced changing regularity. What this means is reduced changing dissipation and greater performance. Moreover, this topology uses changes with reduced malfunction voltage; therefore, it can be used in greater energy programs at cheaper. In comparison to the multiple beat ripper, multilevel converters are more versatile and have a wide application. They can be used as effective energy filtration and to deal with uneven plenty. No stage move transformer is needed in these settings, so a reduced financial commitment price, plus a reduced energy reduction, can be thought [8].

The multilevel ripper settings can be further categorized into three different configurations: Diode- held converter, Flying capacitor converter Cascaded ripper. In comparison to the multiple beat ripper, multilevel converters has many advantages. They can be used as effective energy filtration and to deal with uneven plenty. No stage move transformer is needed in these settings, so a reduced financial commitment price, plus a reduced energy reduction, can be thought. The multilevel ripper settings can be further categorized into three different options. Among the available multilevel ripper topologies, the cascaded multilevel inverter comprises a appealing alternative, providing a flip design that can be extended to allow a transformer less connection. The cascaded H-bridge multilevel Inverter uses individual dc resources (SDCSs). The multilevel inverter using cascaded-inverter with SDCSs digests a desired volt from several individual types of dc currents, which may be obtained from battery power, energy tissues, or solar panels. In Cascaded multilevel inverter

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inverters are connected in series [9]. Each H-bridge ripper unit provides three volts stages (-V, 0, V). As number of stages boosts the outcome waveform becomes perfect. The cascaded multilevel inverter is as shown in Fig 2.

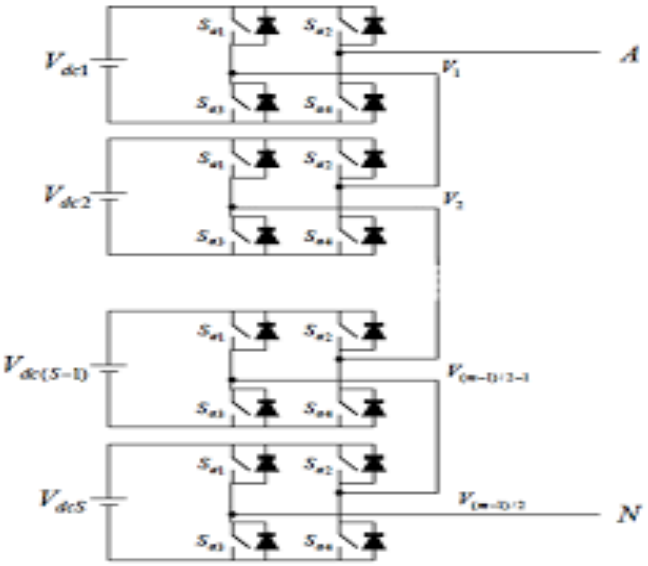

Fig 2. Circuit diagram of m level cascade h bridge multi level inverter

The cascaded H-bridge multilevel inverter is based on multiple two level inverter outputs (each H-bridge), with the output of each phase shifted. Despite four diodes and switches, it achieves the greatest number of output voltage levels for the fewest switches.

IV. PROPOSED CONTROLLER

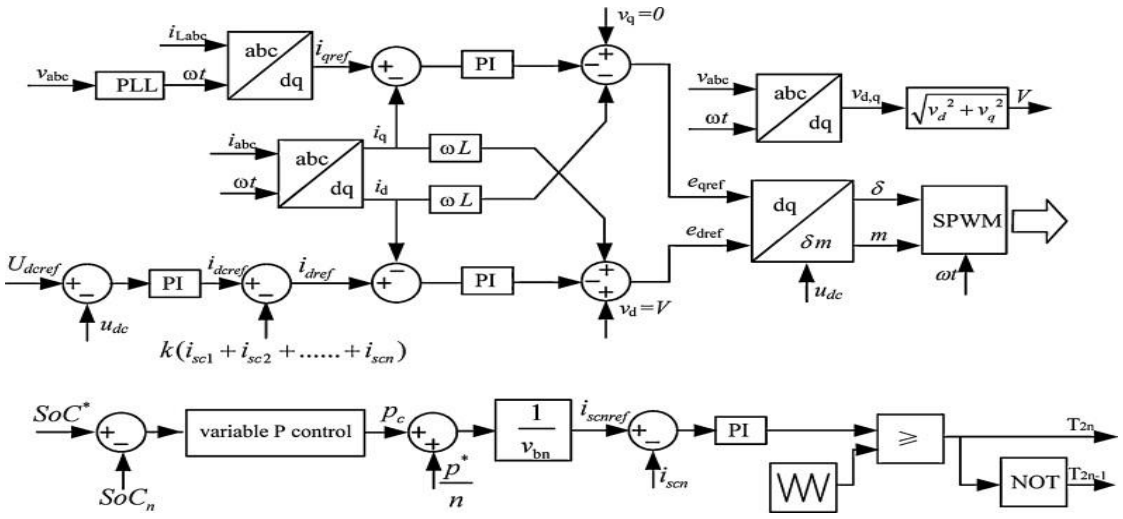

Fig 3. Control unit for a STATCOM

Abc-dq0 Transformation

This block performs the abc – dq0 transformation on a set of three phase signals. It computes the direct axis Vd, quadratic axis Vq, zero sequence quantities Vo, in a two axis rotating reference frame according to following transformation.

$$V_d = \frac{2}{3}(V_a \sin(\omega t) + V_b \sin(\omega t - 2\pi/3) + V_c \sin(\omega t + 2\pi/3))$$

$$V_q = \frac{2}{3}(V_a \cos(\omega t) + V_b \cos(\omega t - 2\pi/3) + V_c \cos(\omega t + 2\pi/3))$$

$$V_0 = \frac{1}{3}(V_a + V_b + V_c)$$

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Dq0_abc transformation

It transforms three quantities (direct axis, quadratic axis and zero sequence components) from three phase quantities expressed in a two axis reference frame back to reference phase quantities. The following transformation is used :

$$V_a = V_d \sin(\omega t) + V_q \cos(\omega t) + V_0$$
$$V_b = V_d \sin(\omega t - 2\pi/3) + V_q \cos(\omega t - 2\pi/3) + V_0$$
$$V_c = V_d \sin(\omega t + 2\pi/3) + V_q \cos(\omega t + 2\pi/3) + V_0$$

V. SIMULATION RESULTS

D-statcom with open loop control:

The power quality is increasing by decreasing the THD value; this can be done by increasing the number of levels of CMLI. If the number of levels of CMLI increases the desired output waveform will have good sinusoidal shape.

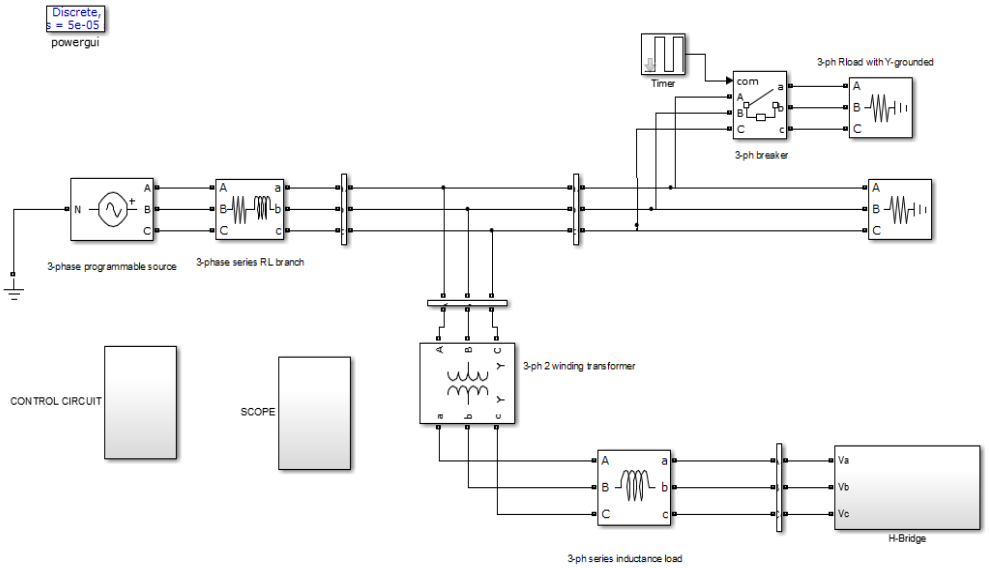

Fig 4. Simulation diagram for D-STATCOM

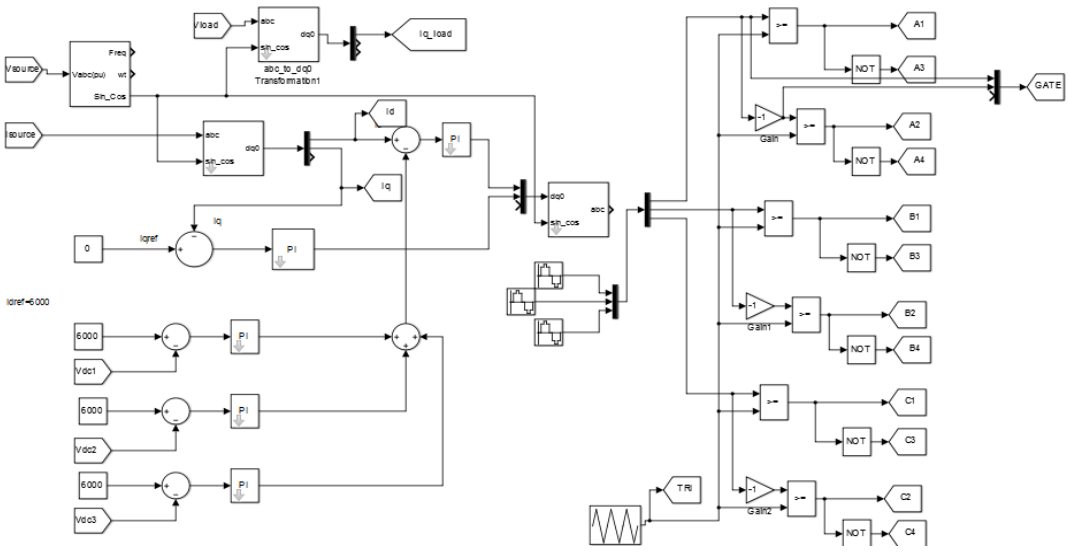

Fig 5. Sub circuit of control unit

The performance of the designed D-STATCOM, as shown in Figure, is evaluated using Matlab/Simulink.. The corresponding voltage and current waveforms of this D-STATCOM is shown in below fig.

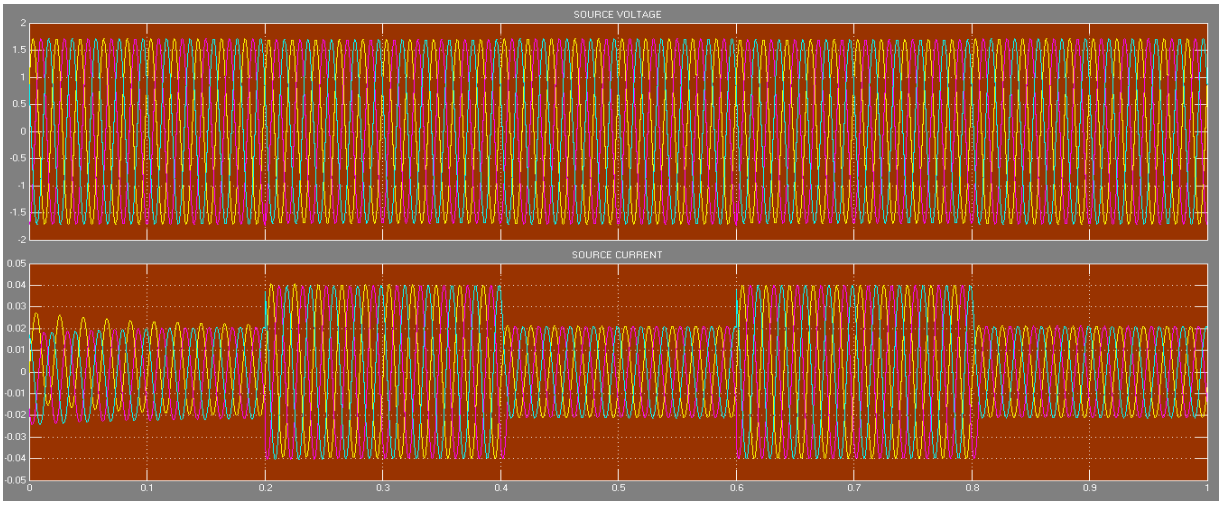

Fig 6. Source Voltage & Current wave forms

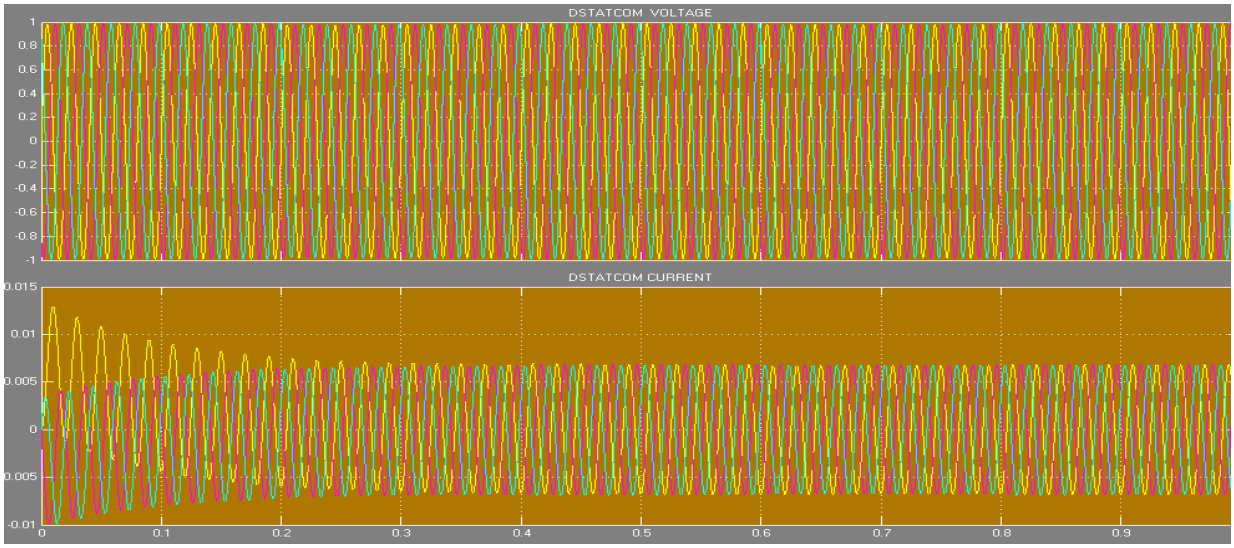

Fig 7. D-STATCOM Voltage & Current wave forms

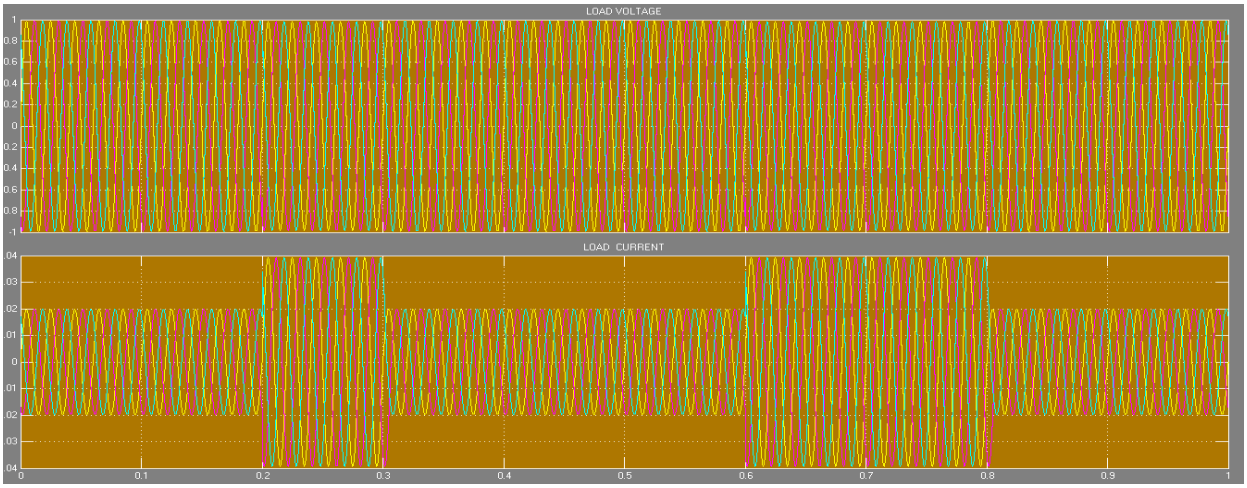

Fig 8. Load Voltage & Current wave forms

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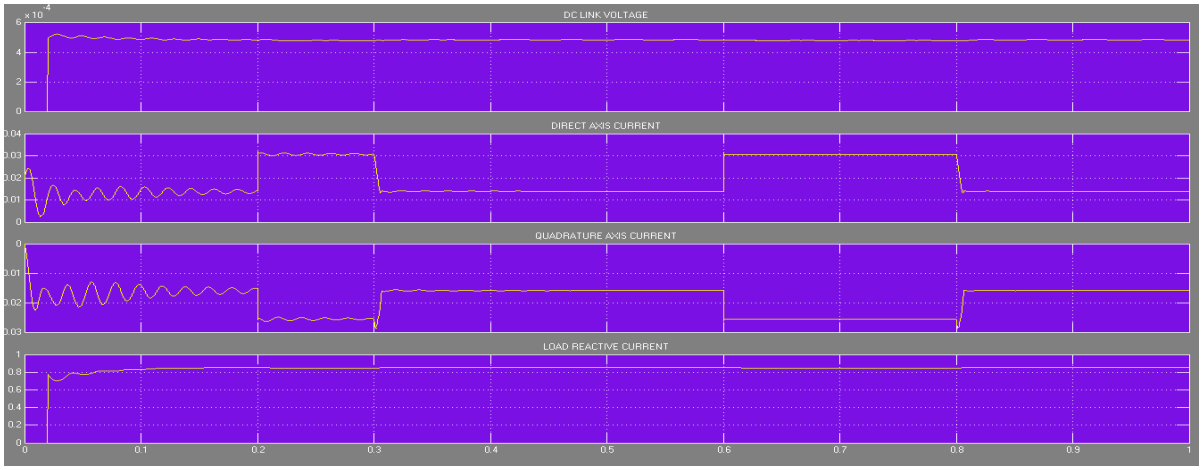

Fig 9. D-Axis &Q-Axis Voltage & Current wave forms

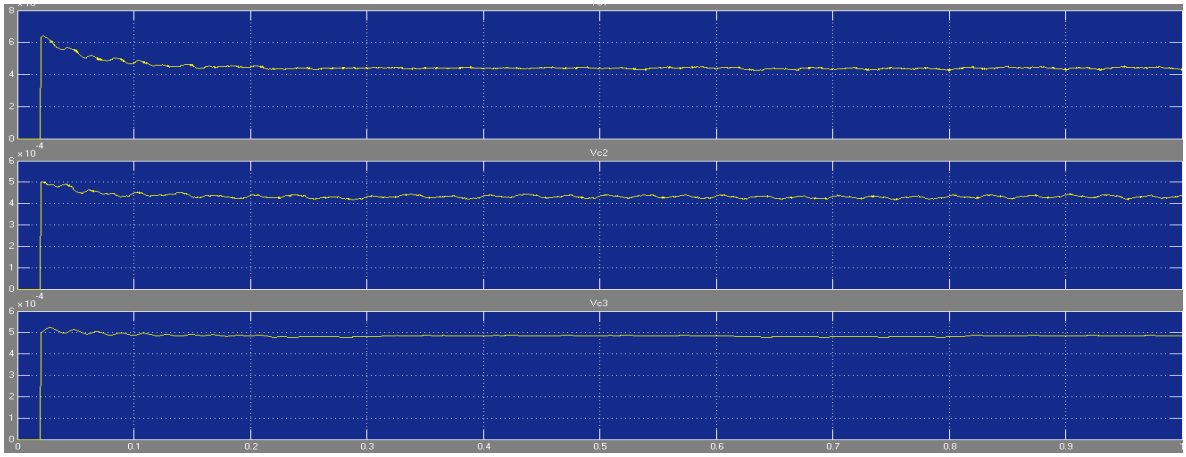

Fig 10. Capacitor voltage wave forms

D-STATCOM CLOSED LOOP CONTROL:

The performance of the designed D-STATCOM with closed loop control, as shown in Figure, is evaluated using Matlab/Simulink.. The corresponding capacitor voltage and current waveforms of this D-STATCOM is shown in below fig.

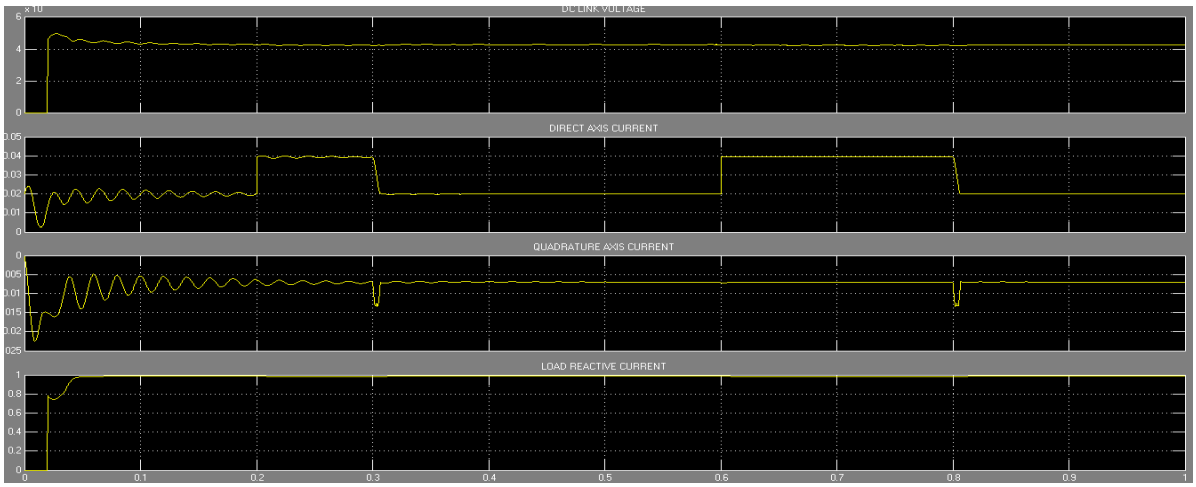

Fig 11. D-Axis &Q-Axis Voltage & Current wave forms

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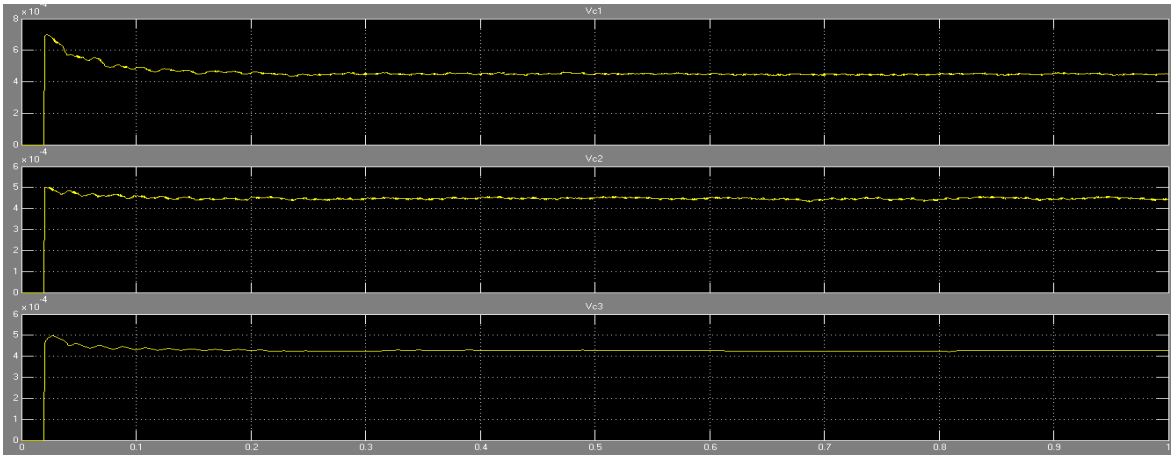

Fig12. Capacitor voltage wave forms

VI. CONCLUSION

A cascaded multilevel volts resource inverter based DSTATCOM using immediate real- energy operator can be found to be an effective remedy for energy line training. DSTATCOM with the suggested operator decreases harmonics and provides sensitive energy settlement due to non-linear fill currents; as a consequence resource current(s) become sinusoidal. The cascaded inverter changing alerts are produced using triangular-sampling present controller; it provides a powerful efficiency under temporary and stable state circumstances. As obvious from the simulator research, dc bus capacitor volts forms beginning and has little swell because of the existence of PI-controller.

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