

# ANALYSIS OF POWER QUALITY USING THD\_D-STATCOM CONTROLLING SYSTEM MODULE

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## ABSTRACT

In this studied and mentioned concerning the custom power device i.e. D-STATCOM that operates on low voltage and however it is helpful in compensation of reactive power as it injects the reactive power in the line. The device is truly acting as VSC that is been enforced at the load facet of the system therefore as to improve the voltage profile of system and scale back the ability losses. Hence, D-STATCOM improves the voltage stability of system. Simulation and modelling of THD-D-STATCOM using PI scheme has done with the Simulink/MATLAB tool.

**Keyword:** D-STATCOM, THD, VAR, VSC, PI, IGBT.

## 1. INTRODUCTION

The STATCOM has managed reactive-electricity supply. It gives the favored generation of power in term of reactive and absorption absolutely via digital processing waveforms of voltage & current in the VSC. A STATCOM precept figure is proven underneath diagram 1.

Reactive electricity power will increase the transmission gadget losses and decreases the electricity transmission functionality of the transmission traces [8-11]. Moreover, reactive electricity float thru the transmission traces can reason big amplitude versions withinside the receiving-give up voltage. Reactive electricity repayment is the vital problem withinside the manages of electrical electricity systems. This impact of STATCOM in electricity gadget on reactive electricity manage through right modelling of easy electricity gadget and voltage supply converter primarily based totally STATCOM the use of Simulink and sim-electricity gadget toolboxes in MATLAB.

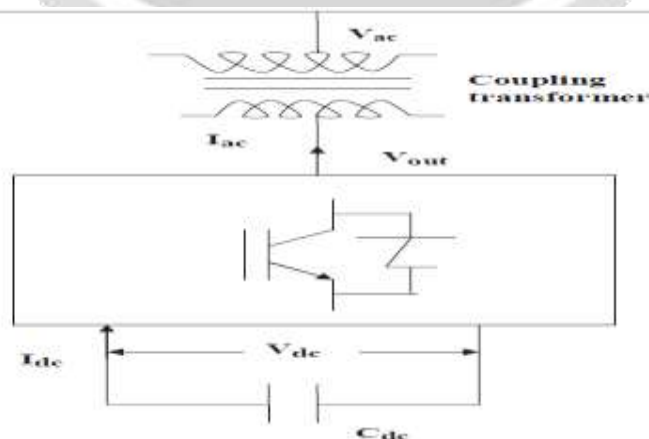


Figure 1: The STATCOM Functional Module [12]

## 2. LITERATURE SURVEY

In this section of discusses ton of analysis papers and draw some conclusion in terms of literature gap or analysis gap and so conjointly known the matter statement. This section of the paper conjointly describes the technologies behind the idea of intrinsically the D-STATCOM into the long run wattage system.

[1] **Prabir Ranjan et al:** The contributions of those power quality problems are severe in our existing electrical systems today. during this work the estimation and mitigation of voltage sag, voltage swell, voltage fluctuation and reactive power limiting for completely different loading condition in utility by victimization Custom Power Devices.

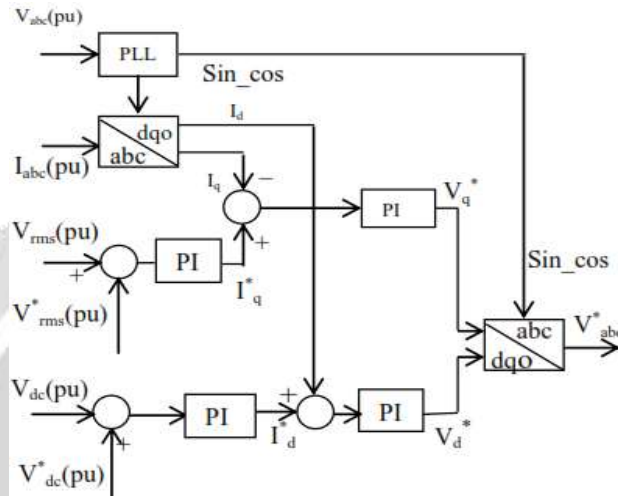


Figure 2: Control Block for the D-STATCOM Model [1]

The D-STATCOM has taken as a compensating device, since it known for its plasticity, straightforward implementation, dynamic load compensation & multifunctional operation because the management block for this model shown within the figure a pair of. The model of D-STATCOM connected in shunt with a three-phase supply feeding a constant and a variable load, that is develop through Simulink.

[2] **R. Ragesh et al:** In this paper, the performance analysis DSTATCOM with general management theme having a novel capability of compensating load reactive power, harmonics and load active power is investigated by transient simulation mistreatment MATLAB- SIMULINK.

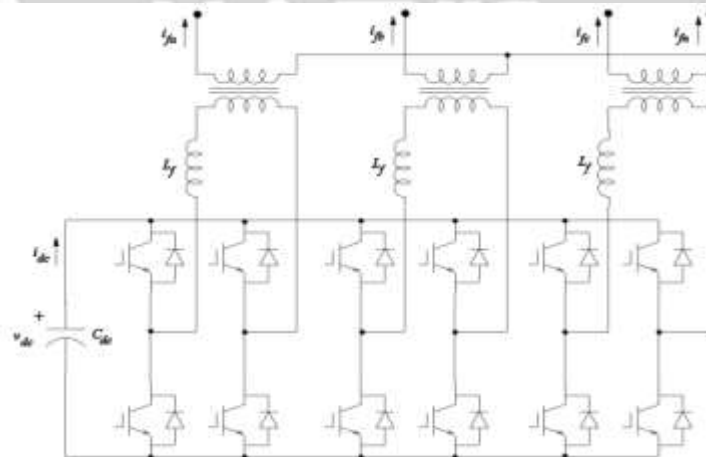


Figure 3: D-STATCOM Circuit Structure [2]

In reactive power management mode, quantity or the quantity or the number of reactive powers delivered from the supply will be created equal to the desired worth by injecting needed amount of reactive power from DSTATCOM. The simulation result validates the role of the SVPWM based mostly DSTATCOM in delivering balanced curved supply currents, though the load carries unbalanced and distorted currents.

[3] **Bhagyashree Mali et al:** The D-STATCOM is connected between supply and cargo. The results square measure taken within the power grid model with and while not the D-STATCOM for hundreds. For every kind, the readings square measure taken for with and while not the D-STATCOM and square measure compared. In the simulation, the output of system while not D- STATCOM is 4.3V because of RL load, when connecting D-STATCOM in the system output is eleven.3V. From the results of simulation, they'll conclude that D-STATCOM is in a position to compensate the voltage.

[4] **Manish Kumar et al:** This study provides an effect theme for distribution static compensator (DSTATCOM) that compensates three-phase, four-wire distribution system and operates the DSTATCOM in voltage management mode (VCM) as shown within the figure 4.

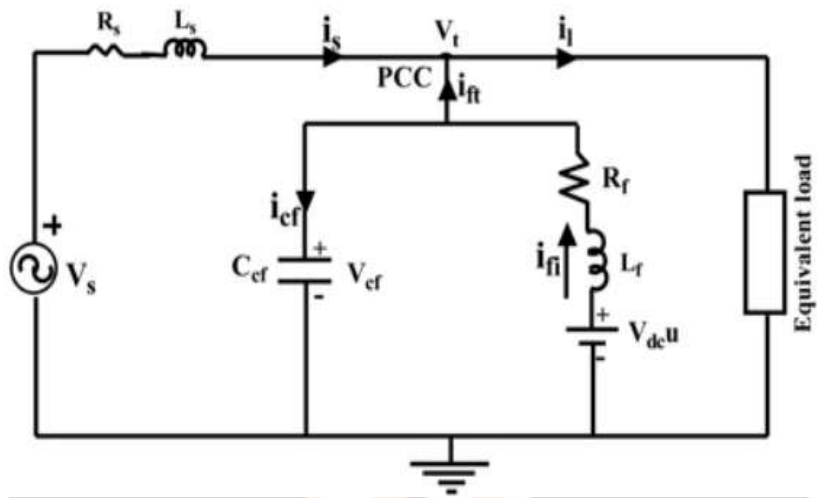


Figure 4: Compensated Circuit of D-STATCOM [4]

This this algorithmic program provides accomplishment of benefits of current management mode operation whereas DSTATCOM operated in VCM. Compensator injects reactive and harmonic element of load current and it provides quick voltage regulation at the load terminal with maintaining nearly unity power issue (UPF). Debtor voltage management law is employed for generating switch pulses for insulated gate bipolar semiconductor device (IGBT) switches and reference terminal voltage is generated by system in such some way that time of common coupling maintains nearly UPF.

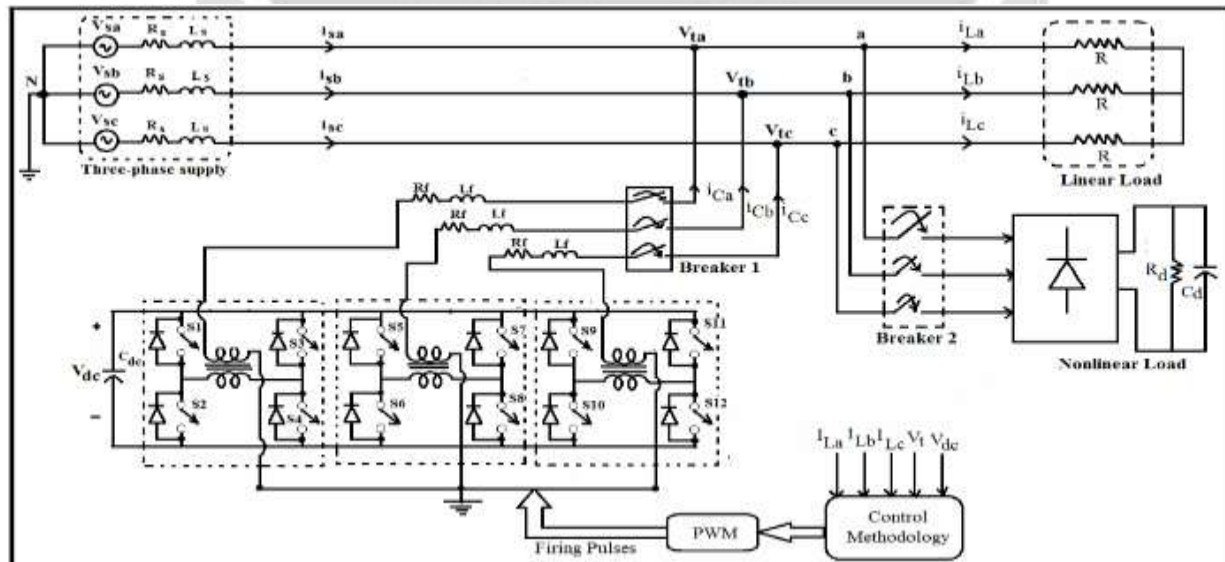


Figure 5: Schematic D-STATCOM based on VSI [5]

[5] **Prasad Miska et al:** A DSTATCOM is one in all the most important power quality improvement devices that include a DC energy supply, a voltage supply electrical converter (VSI), a filter, a coupling electrical device and therefore the system. The management strategy supported synchronous organization (SRF) theory and propositional-integral (PI) controller has been used for reference current generation of voltage supply electrical converter (VSI) primarily based DSTATCOM as shown within the figure five. The SRF and PI management primarily based DSTATCOM is valid through dynamic simulation in an exceedingly MATLAB\SIMULINK atmosphere below linear additionally as nonlinear masses.

[6] **Vijay M. Awasthi et al:** D-STATCOM may be a compensating device that is employed to regulate the flow of reactive power within the distribution systems. Most of masses during this system, being inductive in nature consume a lot of reactive power. As a result, power issue of load deteriorates and this limits the active power flow within the line. This paper aims at developing a D-STATCOM, supported voltage supply device that injects the reactive power in distribution line. The output voltage of D-STATCOM is created resulting in that of system voltage for the aim of dominant volt-ampere generation. Implementation of D-STATCOM by victimization PI controller is administered in MATLAB/ Simulink.

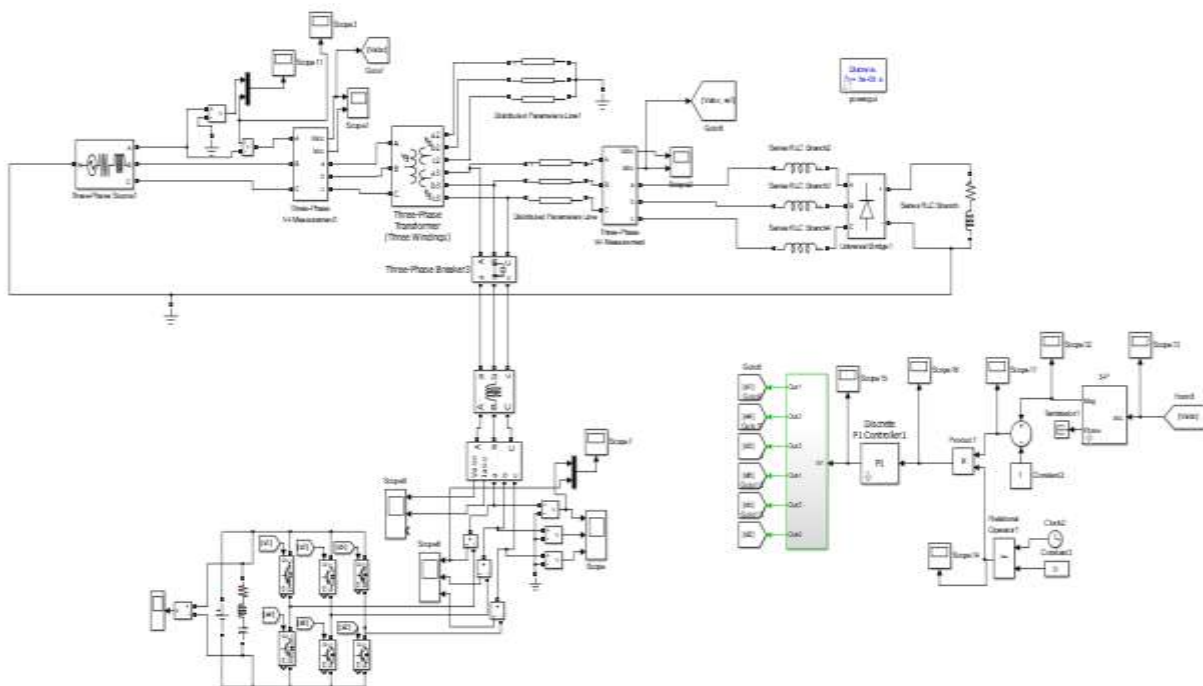
[7] **Ravindra Kumar et al:** versatile AC Transmission Systems devices square measure changing into the imperative half of the transmission system network for power transfer improvement. In this work, the impact of Static Compensator parameters has been analyzed for obtainable transfer capability (ATC) improvement.

### 3. PROBLEM IDENTIFICATION

The development of technology and resultant up gradation of the masses on grid, have led to a paradigm modification within the customer’s outlook for the electrical power, is willing to receive. Adding to the matter of reactive power compensation, the proliferation of nonlinear masses is inflicting a better level of harmonics within the received voltage. Associate alert client currently asks for an influence offer that's voltage regulated, balanced, glints free, while not harmonics and while not any outages.

### 4. SIMULINK MODEL & RESULTS

A schematic representation in diagram 6 DSTATCOM consists of a two-stage voltage supply converter (VSC), a DC energy storage device, and an electrical coupling device that is connected to the distribution network via an electrical coupling device.



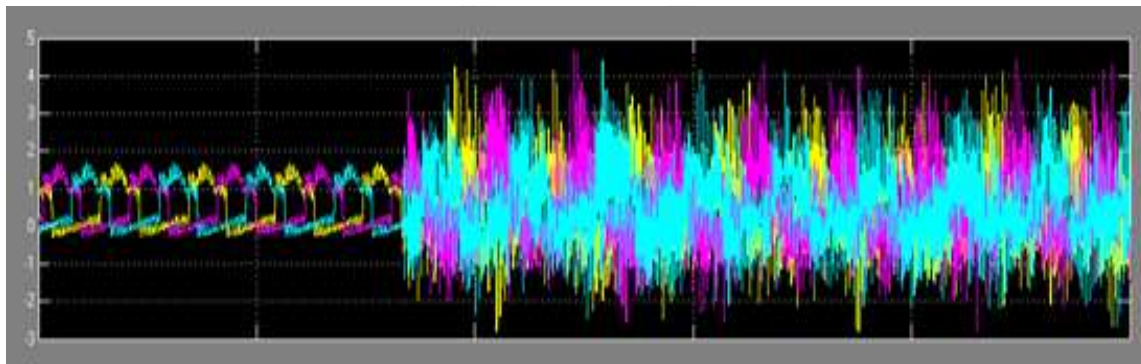
**Figure 6: Proposed D-STATCOM Control Model**



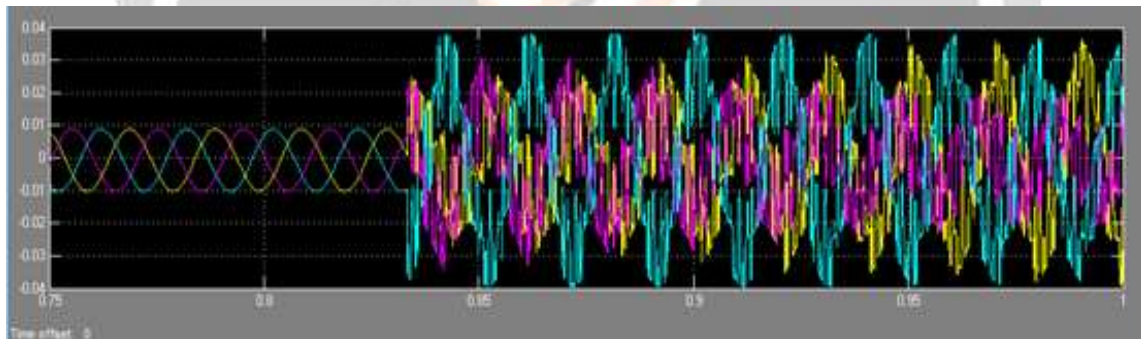
For the numerous achievement the system accomplished with topology which perform multifunction. In this system module the shunt connected VSC module ha used to provide high quality AC power, the main purposes of this module discuss as following;

- A. Regulation, compensate the voltage and power i.e. reactive respectively
- B. Improving power factor
- C. Mitigation of reverse leakage current i.e. harmonics

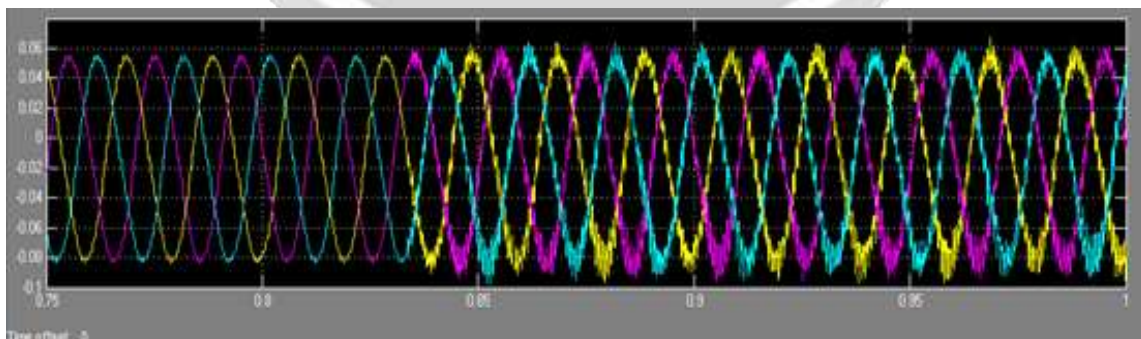
As we know that the fact devices or elements generally provided regulation of voltage by utilizing controller mechanism indirectly. As above depicted figure 6 shows that the controlling mechanism module of D-STATCOM which is providing sag correction in voltage by using appropriate injection of shunt current at non-linear load and also manage the converter output voltage via controlling the shunt current.



(a)



(b)



(c)

**Figure 7: Simulation Waveform for  $t = 0.75$  to  $1.0$ ; (a) Supply Voltage, (b) Load Current, (c) Compensating Current through D-STATCOM**

As depicted figure 7 shows the output wave current and voltage with RL load without D-STATCOM and Output waveform voltage and current with RL load with D-STATCOM respectively. It is very clear from the output results waveform (voltage and current) shows less harmonic and better stability with RL load using D-STATCOM system as compare to the without D-STATCOM system module.

## 5. CONCLUSION

Power system enhancement become a most important task for the modern transmission system, for this FACTS device takes a most realistic role of the transmission system network. For achieve this kind of smoother transmission analyzed the D-STATCOM with controller i.e. PI controller based on PWM and SVPWM control mechanism for available transfer capability enhancement.

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