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A Review Paper on D-STATCOM

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Abstract: In this paper the aim of various FACTS devices have been studied. Various power electronics devices plays very significant role in FACTS devices .The switching capabilities of power electronics devices can be effectively used to enhance the power quality. Various FACTS devices has been established for control of various problems related to power quality such as DVR,SSSC,TCSC,D-STATCOM etc. In these paper the charactertics of D-STATCOM has been discussed .
Keywords: Power quality, FACTS , reactive power, SSSC, TCSC, D-STATCOM

I. INTRODUCTION

Nowadays, the major topic that has been the centre of attraction to the electrical engineer is the issue of "POWER QUALITY" .The term power quality is generally used in transmission, distribution, and utilisation for maintenance of good power quality .It is important to study the pollution of electric power supply in utilisation because it is more severe here.

It is essential that the electric power quality should remain in standard limit. The fluctuation in power quality is generally noticed in distribution and transmission system. The major problem that generally occurs in due to power quality is voltage sag ,voltage swell,harmonics etc. Reactive power compensation techniques is cannibalized to keep performance of system at a good quality.[1]

FACTS devices are widely used for enhancement of dynamic and transient stability ,voltage stability ,line compensation , power factor improvement . The Facts devices in a transmission system is assemble of high speed thyristors bases high speed controllable elements such as SVC, phase shifters ,dynamic breakers etc [2]

The classification of FACTS devices is as follows

Series controller

Shunt controller

Combined series series controller

Combined series shunt controller. [3]

Why reactive power compensation is needed?

1) To balance the voltage magnitude between sending end and receiving end as required.
2) Improvement of stability.
3) To reduce losses
4) To restrict voltage collapse as well as voltage sag[4]

Each FACTS devices either it is shunt or series has its own advantages and disadvantages. Some FACTS devices are illustrated below

a) SVC is one of a type of static VAR generator which is used to balance or control spefic power system variables in which output is adjusted to exchange capacitive or inductive power.
b) TCSC is a combination of TCR in parallel with fragments of series capacitors banks .The capacitive reactance is fluently controlled over a wide range with the combination of TCR and capacitors.
c) SSSC consist of DC to AC inverters with gate turn off thyristors, which is based on solid state synchronous voltage source and used in transmission line for series compensation
d) UPFC consist of series and shunt,both type of VSI which is operated via a common DC link in conjuction with a DC storage capacitor . The control of active and reactive power flows on the line as well as bus voltage because of these two inverters. There is no restriction to the flow of active power between the Ac terminals of the two inverters through DC link .Both the inverters cannot internally exchange reactive power through dc link [5]
e) STACOM which is constructed of of three phase bridge inverter which uses SCR,MOSFET,IGBT,GTO as switch, a dc capacitor which fulfil the need of DC voltage for the inverter ,a link reactor which connects the inverter output to the ac supply , different filter components to filter out the harmonics due to high frequency which causes because of inverter.**[6]**

There are many traditional static VAR compensators but STATCOM always have a better performance on compensating reactive power and have the potential to keep the voltage of the point of common coupling stable**[7]**

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II. STATE OF THE ART OF D-STATCOM

The D-STATCOM technology is used for providing reactive power compensation when power quality issues occurs such load unbalancing ,poor power factor ,poor voltage regulation ,excessive neutral current etc.One of the major factors that D-STATCOM is used nowadays frequently is the advent of fast,self commutating solid device.

III. D STATCOM

D STATCOM or distribution STATCOM is a FACTS device which is utilised to control voltage instability ,flickers which cause due to the disturbance in distribution lines by injecting reactive power to the line to compensate the reactive power.
There are two modes to control D STATCOM , voltage mode control and current mode control.
In voltage mode control, the dc bus voltage is made sinusoids, whether the load side or source side current.
In current mode control, the source side current to be balance sinusoids. [8]
The operating principle of D STATCOM is based on generalised instantaneous power theory which can be applied for both sinusoids or nonsinusoids , balance or unbalanced 3 phase power system with or without zero sequence components.
The instantaneous power theory produces the reference current which is required to compensate the current harmonics in distorted line and reactive power.[9]

IV. PRINCIPLE OF D STATCOM

It consist of following components

A. Voltage source converters
B. Dc energy storage device
C. A coupling transformer connected in shunt to the distribution network through a coupling transformer.

The dc voltage across the storage device is connected into set of three phase ac output voltages by VSC. These voltage are coupled with the ac system and in phase with it through the reactance of coupling transformer. By adjusting the output voltage of STACOM, reactive and active power between the DSTACOM and ac system can be controlled.**[10]**

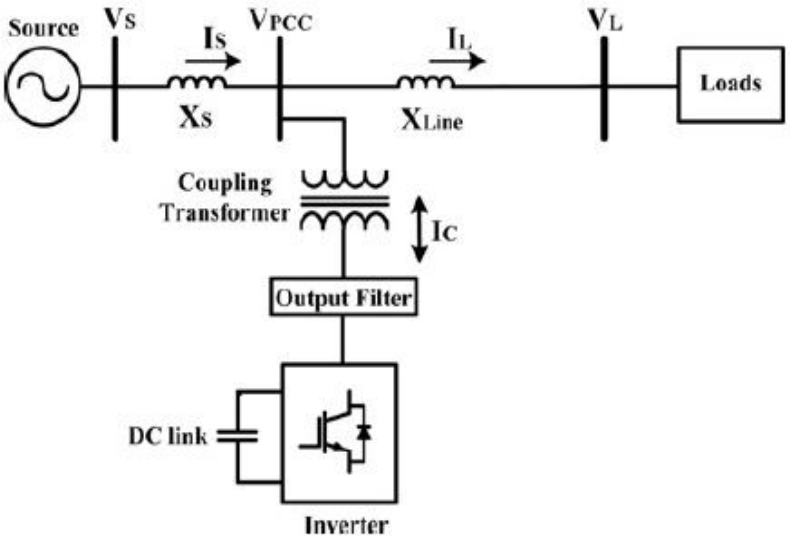

Figure1. Schemtic Diagram OF D-STATCOM

1) If V1=Vpc, than reactive power exchange between the D STATCOM and utility grid is zero, In that case D STATCOM neither absorb nor generate any reactive power.
2) V1>Vpcc ,D STATCOM acts as a inductive reactance connected at its terminals. Here device generate reactive power.
3) V1<Vpcc than DSTATCOM acts as capacitive reactive power.Here device absorbs inductive reactive power**[11]**

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V. CONCLUSION

The wide use of power electronics devices in electronic appliances results in harmonics, voltage fluctuations, voltage flickering, excessive neutral current which results in poor power quality. Active power filtering is expected to be a better option .There are many FACTS devices which are used to mitigate various power quality issues. The current based problems are eliminate by D-STATCOM. There are various methods that can be employed on D-STATCOM depending upon the results needed. It can be used as VSC or CSC depending upon the problems which needs to resolve.

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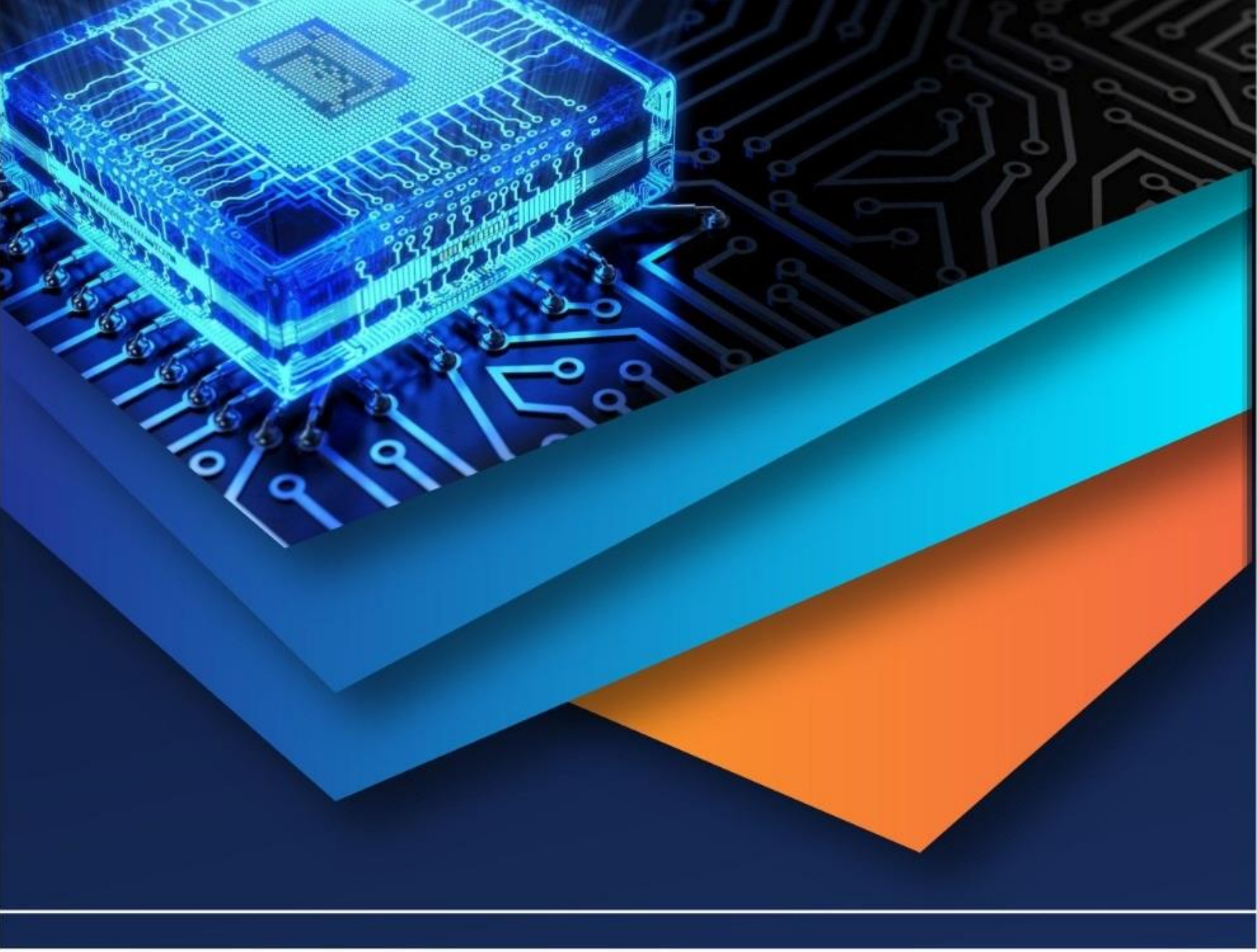

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