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Placement and Performance Analysis of D- STATCOM for Power Quality Maintenance

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Abstract : In a Power System main problem is power quality at the receiving side which is mainly related to the voltage fluctuation current and frequency. The main aim of this paper is to represents a role of D-STSTCOM in power system before fault during fault and after fault condition and analysis power quality by DSTATCOM When fault occurs in power system at different causes the D-STATCOM will regulate supply voltage by absorbing and providing reactive power to mitigate voltage sag .

Key word: Distribution STATCOM (D-STATCOM) Voltage Sags, Voltage source Converter (VSC)

1.INTRODUCTION

A receiving side voltage and current of distribution system suffer from power quality problem which reason is suddenly increases on load transient on supply voltage, poor power factor and harmonics in supply system. There are many types of power quality problem.

1. Voltage sag
2. Voltage sweel
3. Harmonics
4. Voltage transient
5. Flicker

A D-STATCOM is connected at the receiving side of distribution system to mitigate types of power quality problem. When we show receiving side of the voltage of distribution system is low level then STATCOM is identify

D-STATCOM. Although these two FACT device are shunt connected devices. A STATCOM is used where a set of three balanced quasi-sinusoidal voltages are required and phase p displaced by 120°,but the D-STATCOM is used where unbalance and harmonically distortion in current in that condition the D- STATCOM eliminate unbalance or distortion in the load current or the supply voltage. We can used D-STATCOM as a VSC- and CSC-based D-STATCOM in power system. Basically a shunt connected static VAR compensator whose Capacitive or Inductive output current can be controlled and does not dependent of the ac supply system. A STATCOM can be used as a active filter to absorb system harmonics

2. D-STATCOM (DISTRIBUTION SATIC

COMPENSETOR)

D-STATCOM (Distribution Static Compensator) is a shunt device used in distribution system to solve power quality related problems. problems in distribution systems. A DSTATCOM is a controlled reactive source, which consist of a Voltage Source Converter (VSC) and a DC link capacitor and these capacitor connected in shunt, and capable of generating and/or absorbing reactive power. A voltage source converter(VSC) is heart of the D-STATCOM (Distribution Static Compensator).The input side terminal of the voltage source converter is connected to the Point of common coupling through an inductance .The D.C. side of voltage source converter is consist of D.C. capacitor which takes input ripple current of converter and this is main energy storage element. This D.C. capacitor is chard by battery source or by converter. If the output voltage of VSC is equal to supply AC system there is no reactive power transfer takes placed. If output voltage of VSC is more than A.C. terminal voltage the D-STATCOM operated as capacitive mode and vice versa The balancing reactive power flow in power system is proportional to the difference in the two voltages.

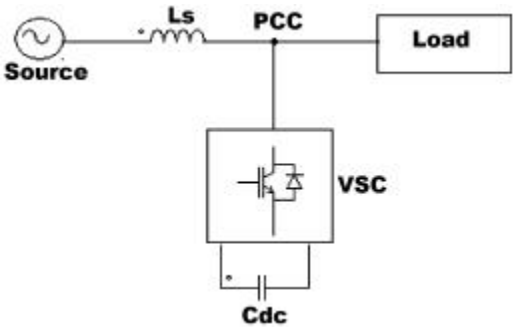

Figure-1
Basic structure of DSTATCOM

3.Simulation Model of Test System With and Without D-STATCOM and its Operation:

We considered in test system generating unit 25kv, 50HzTheTest system considered to carry out simulation taken D-STATCOM actuation. The output voltage of generating unit is fed to primary side of three phase winding transformer . Further we also considered two parallel feeder each drawn 11 kv. In one of the feeder D STATCOM is connected shunt and operation fallow by circuit barker and one of feeder is left as it is. For this test model we considered a nonlinear load at the end of feeder consisting of D-STATCOM . For control scheme PI controller is used. The simulation is takes place between time 0.4 sec to 0.9 sec. When simulation takes place circuit

Breaker is not connected. The simulation is carried out between time 0.4 to 0.9 sec. During which circuit breaker is not connected to.

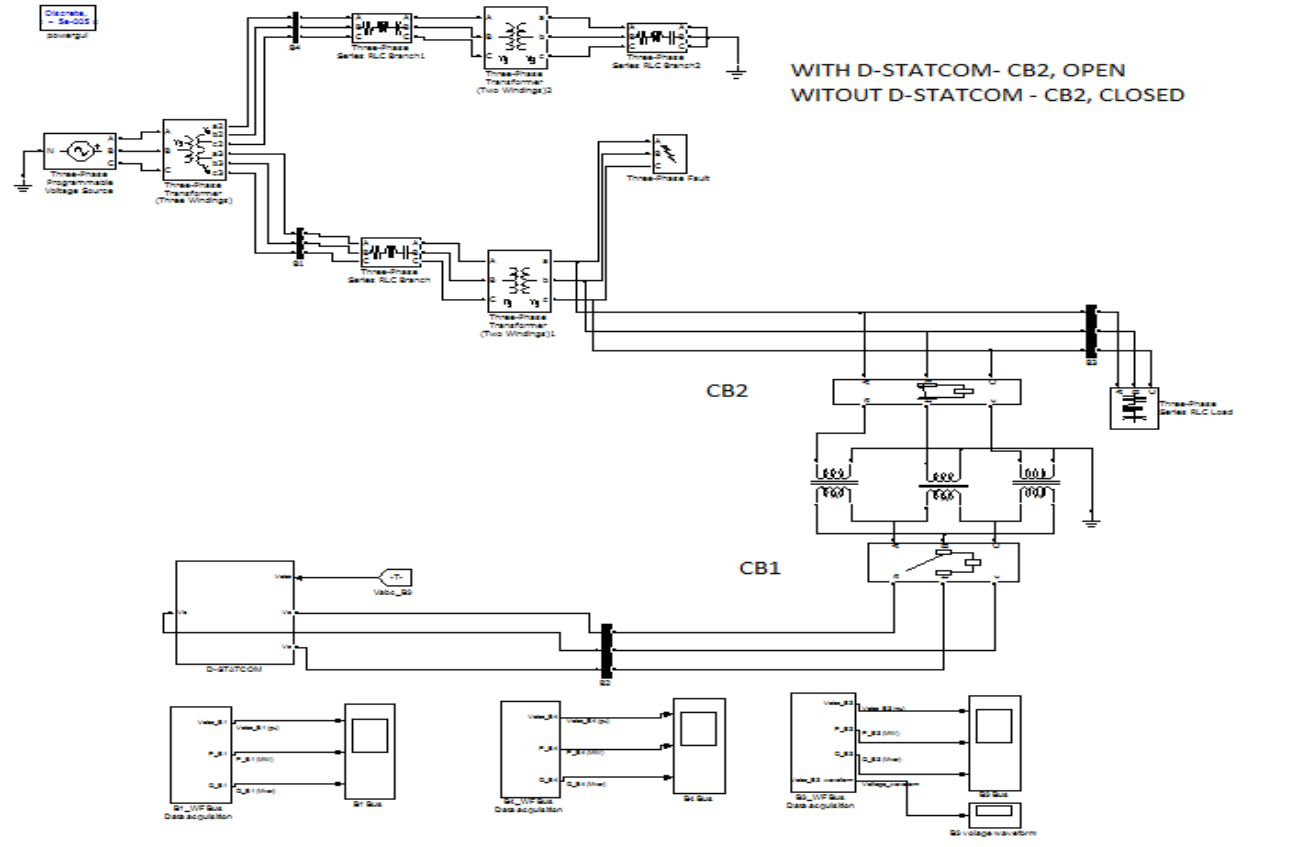

FIG 3 simulation test mode

4.PARAMETER OF THE TEST SYSTEM:

This simulation model considered non linear load has been tested on different fault conditions. This simulation model consist of thee phase programmable voltage source with configuration of 25kv , 50 Hz. The source is taken two transmission line through a three phase winding transformer with power rating 250 MVA

5. SIMULATON RESULTS: CASE 1. : SINGLE LINE TO GROUND FAULT (LG) CONDITION:

In case of single line to ground fault condition fault to be taken on both feeder. the fault resistance is 0.98ohm and ground resistance 0.001 ohm and duration of fault is 0.4 to 0.9 sec Winding 1: V1rms (Ph-Ph) = 25kv, R1= 0.002(pu), L1 = 0.08002(pu) Winding 2: V2rms (Ph-Ph) = 11kv, R2= 0.002(pu), L2 = 0.08002(pu) Winding 3: V3rms (Ph-Ph) = 11kv, R3= 0.002(pu), L3 = 0.08002 (pu) Inverter Parameter : IGBT based , 3arm , 6 pulse , carrier frequency = 1080Hz. sample time = 5µ sec. the power system, such as CB2 is closed when D-STATCOM is not in operating mode.

5.1 RESULT WITHOUT D-STATCOM (LG Fault):

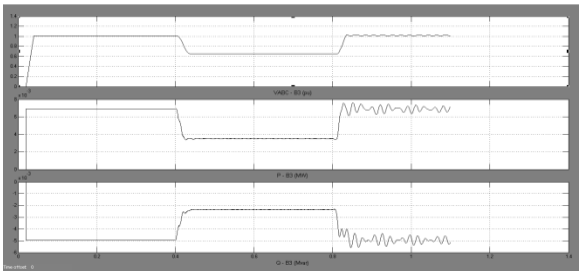

Fig.5.1Three Phase Voltage(pu), Active Power and Reactive Power at Bus 3 Without D-STATCOM (LG Fault)

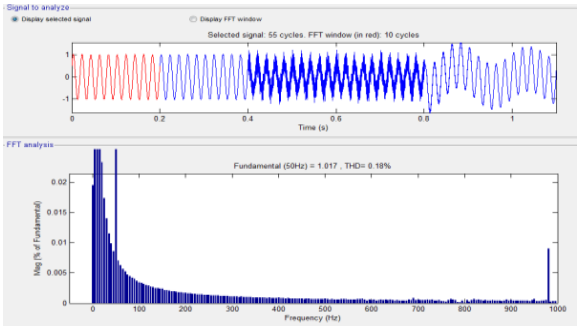

Fig.5.2 FFT Analysis Before Fault Without D-STATCOM (LG Fault)

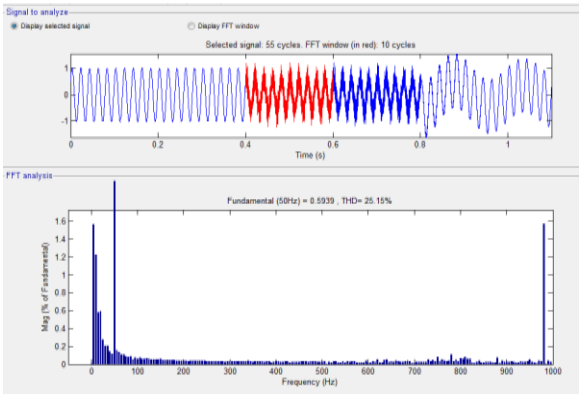

Fig.5.3 FFT Analysis During Fault Without D-STATCOM (LG Fault)

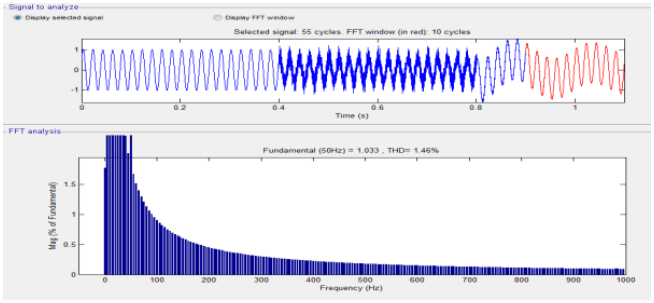

Fig.5.4 FFT Analysis After Fault Without D-STATCOM (LG Fault)

5.2 RESULT WITH D-STATCOM (LG Fault):

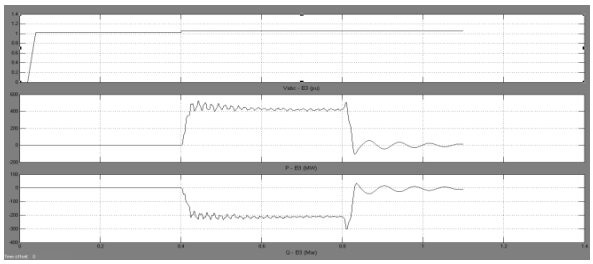

Fig.5.5Three Phase Voltage (pu), Active Power and Reactive Power at Bus 3 With D-STATCOM (LG Fault)

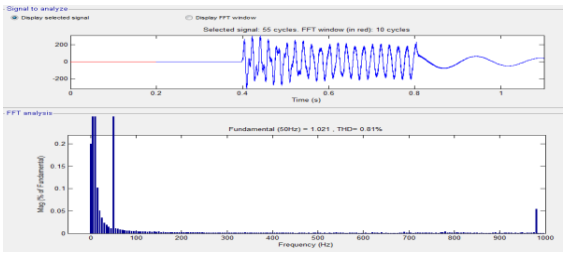

Fig.5.6 FFT Analysis Before Fault With D-STATCOM (LG Fault.

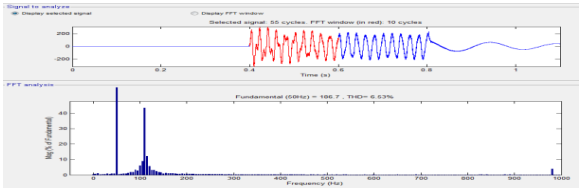

Fig.5.7 FFT Analysis During Fault With D-STATCOM (LG Fault)

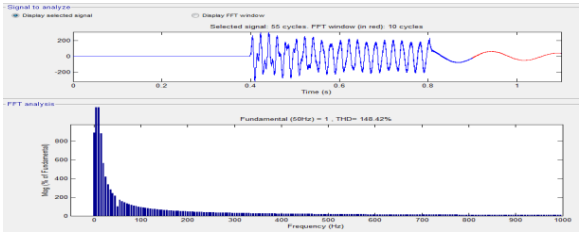

Fig.5.8FFT Analysis After Fault With D-STATCOM (LG Fault)

6. RESULT WITHOUT D-STATCOM (LLG Fault)

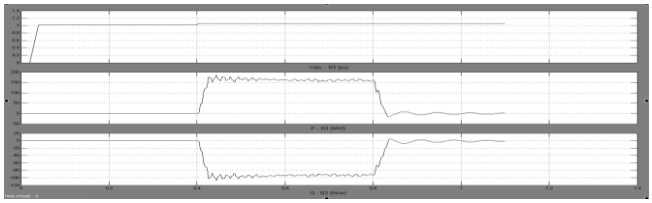

Fig.5.9Three Phase voltage(pu), Active Power and Reactive Power at Bus 3 With D-STATCOM (LLG Fault)

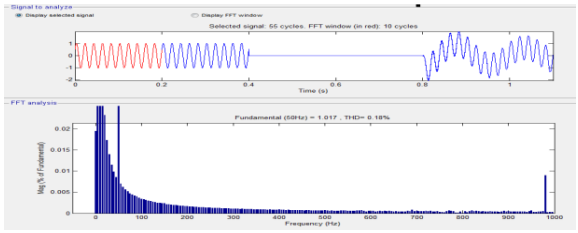

Fig.5.9 FFT Analysis Before Fault Without D-STATCOM (LLG Fault)

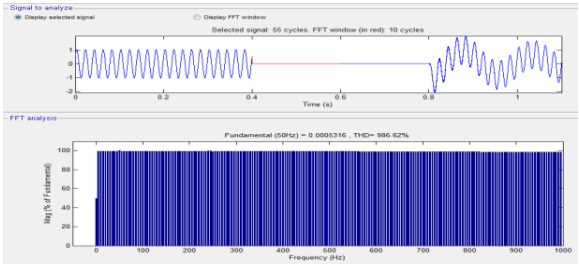

Fig. 5.10 FFT Analysis During Fault Without D-STATCOM (LLG Fault)

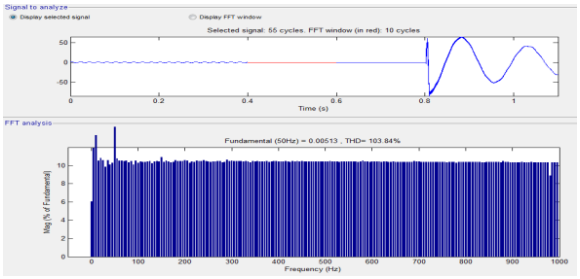

Fig.5.11FFT Analysis After Fault With D-STATCOM

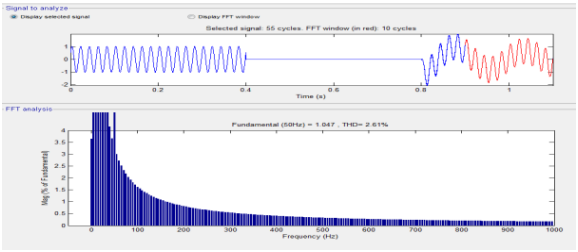

Fig. 5.12 FFT Analysis During Fault (LLG Fault)

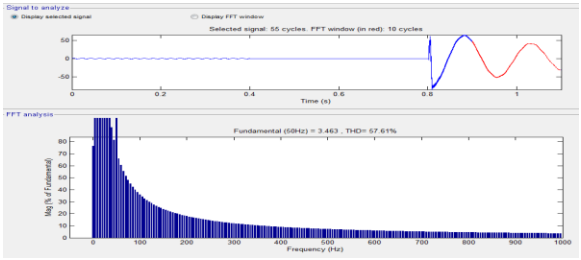

Fig.5.13 FFT Analysis After Fault (LLG Fault)

7. CONCLUSIONS

This paper shown when fault occurs in a power system at different causes. The receiving side of distribution system voltage will effect the system performances. when we used D-STATCOM at duration of fault occurring in power system. the system voltage power quality problem such as voltage dip, voltage swell and interruption etc, will reduce. And system performances is increases .

8. References

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9. BIOGRAPHIES.

Prem Prakash Singh passed B.Tech (Electrical And Electronics Engineering)from Kali Charan Nigam Institute of Technology Banda in 2013 And pursuing M.tech in Azad Institute of Engineering and Technology lucknow .My currently work on the Placement And Performance Analysis Of D- Statcom For Power Quality MAINTENACE.