Study of load compensation with DSTATCOM

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***Abstract*— DSTATCOM is a distribution static compensator which can compensate the voltage and current ,mitigate the current related power quality problems A distribution static compensator is very popular in computing linear and non linear loads DSTATCOM most common use for voltage stability . A DSTATCOM is a voltage converter (VSC) based device with voltage source behind reactor. Single phase load compensation is uses for the purpose of the reducing the reactive and harmonic parts of the load currents.**

***Index Terms*— harmonic compensator, static compensator, power quality issues**

I. INTRODUCTION

In modern trends power system problems such as voltage sag, swell, harmonic is minimized by the voltage compensator (DSTATCOM). The various power devices are DSTATCOM(distribution static compensator), DVR(dynamic voltage restorer),UPQC(unified power quality conductors).the current related power quality problems are mitigated by shunt compensator. In this we show the structure of the load compensator & study the output voltage and current waveform three phase load with DSTATCOM.

II. DSTATCOM COMPONENTS

DSTATCOM involves mainly three parts

IGBT & GTO dc to ac inverter:- these inverters are which create an output voltage waveform that's controlled in magnitude and phase angle produce leading and lagging reactive current depends on the compensation required

L-C FILTER :- The LC filter is used which reduces harmonics moves the inverter output impedances to enable multiple parallel inverters to share current the LC filter is chosen in accordance with the type of the system and harmonics present at the output of the inverter

CONTROL BLOCK:- control block is used which switch pure wave DSTATCOM modules is required they can control external device such as mechanically switched capacitor banks too. These control blocks are designed based on various control theories and algorithm links, instantaneous PQ theory.

III. COMPENSATING SINGLE PHASE LOADS

The schematic diagram of a single phase load compensator is shown in fig.1.In this diagram a voltage source is supplying a load that could be nonlinear as well. The point of connection of the load and the source is the point of common coupling (PCC) since there is no feeder joining the source and the load. here the compensator consists of an H- bridge inverter and interface inductor(Lf).The resistance R_f represents the resistance of the interface inductor due to its finite Q-factor as well as the losses in the inverter .one end of the compensator is connected at the PCC through the interface inductor whole the other end is connected with the load ground. the dc side of the compensator is supplied by a dc capacitor C_{dc}.

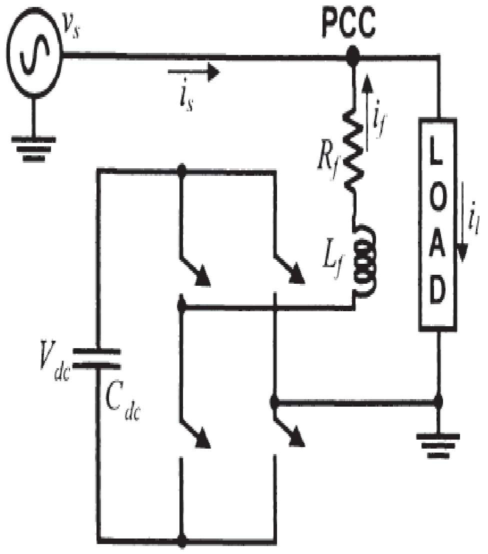

Fig 1 SCHEMATIC DIAGRAM OF SINGLE PHASE COMPENSATOR

Let us assume that the load is nonlinear. The instantaneous load current then can be decomposed as

$$i_l = i_{lp} + i_{lq} + i_{lh}$$

Where i_{lp} and i_{lq} are respectively the real and reactive parts of the current required by the load and i_{lh} is the harmonic current drawn by the load .the purpose of the compensator is to inject current i_f such that it cancels out the reactive and harmonic parts of the load current

Now applying KCL at the PCC we get

$$i_l = i_s + i_f \qquad i_s = i_l - i_f$$

we assume that the compensator operates in a hysteresis control loop in which the compensator current tracks a reference current I_f^* let us now choose this reference current as

$$i_f^* = i_{lq} + i_{lh}$$

if the inverter accurately tracks this reference current, then the source current will be equal to the unity power factor current drawn by the load. Since the compensator does not

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draw or inject any real current, the average power consumed by the compensator is zero.

IV. IDEAL THREE -PHASE SHUNT COMPENSATOR STRUCTURE

To illustrate the functioning of shunt compensator , consider the three phase ,four-wire (3p4w) distribution system in fig 2 all the currents and voltages that are indicated in this fig are instantaneous quantities. Here a three phase balanced supply (v_{sa}, v_{sb}, v_{sc}) is connected across a star (Y) connected load. The loads are such that the load currents (i_{sa}, i_{sb}, i_{sc}) may not balance, may contain harmonics and dc offset. In addition, the power factor of the load may be poor. One implication of load not being balanced in this system is that there may be zero –sequence current i_{Nn} flowing in the 4th wire , i.e., in the path n-N as shown in fig.

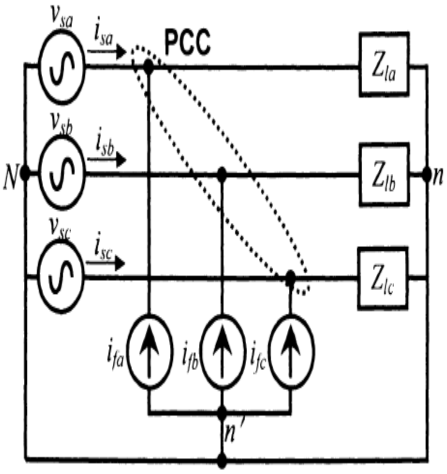

Fig.2 The Three Phase, Four-Wire (3p4w) Distribution System

V. SCHEMATIC DIAGRAM OF A SHUNT COMPENSATOR FOR 3P4W DISTRIBUTION SYSTEM THAT IS SUPPLYING A Y –CONNECTED LOAD

The shunt compensator is represented by three ideal current sources i_{fa}, i_{fb}, i_{fc}.the point of common coupling (PCC) is encircled in fig. the current sources are connected in Y with their neutral n' being connected to the 4th wire . the purpose of the shunt compensator is to inject currents in such a way that the source currents (i_{sa}, i_{sb}, i_{sc}) are harmonic free balanced sinusoids and their phase angle with respect to the source voltages (v_{sa}, v_{sb}, v_{sc}) has desired value

VI. RESULT AND DISCUSSION

DSTATCOM is a device which is used in an AC distribution system, harmonic current mitigation, and reactive power compensation. By this load compensation the power system should run smoothly and properly .we can find out the reference current and voltage.

VII. CONCLUSION

DSTATCOM (single phase & three phase compensation) reduces the harmonic and other power quality problems .it provides better power system .in modern trends uses of the compensator in many countries is increases. It is a best device for power system .

ACKNOWLEDGEMENT

I am thankful to all the faculty members of EE & EEE department to give kind contribution of guiding for publishing the paper.

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