

# COMPENSATING VOLTAGE SAG IN HV LINES USING STATCOM

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Abstract:—Due to unpredicted non-direct loads, control quality issues, a bring up in the transmission framework. One such issue is voltage sag. Voltage droop is expected to the non-direct load which requests receptive power, however the adjusted 3 source gives required receptive energy of the heap with decreased voltage at the less than desirable end. In this paper, reenactment consider has been performed to relieve voltage hang issue. A transmission framework with age source with various stacking conditions is considered and examine has been done. A 3 medium model transmission line is planned with a power wellspring of 33kV. The voltage droop is repaid by a shunt associated remuneration unit called Static Synchronous Compensator. Static Synchronous Compensator gives the required receptive power requested by the non-straight load alongside the hotspot for pay of voltage list. The Static Synchronous Compensator activity is controlled by a control unit which guarantees the nonstop and adjusted power spill out of the source even under sudden change in stack conditions. The recreation comes about are introduced to demonstrate the execution of the created Static synchronous compensator.

*Index Terms* - Power quality, Voltage Source Converter, Synchronous Compensator, Voltage Sag, Non-linear load.

## I. INTRODUCTION:

In India, in the dispersion line either no gadget is utilized to moderate the impacts, for example, voltage drop caused because of higher R/X proportion. The regular gadgets which are utilized have numerous restrictions [22]. The transmission line transmits electrical vitality however the extent of sending end voltage does not show up totally in accepting end because of the misfortunes delivered in the transmission framework. The real reasons for the misfortunes are the protection of the conductor and the responsive influence devoured by the heap is past the utmost produced by the source. [1] This prompts the crumbling of

PQ benchmarks of the transmission line and it influence the activity of certain electronic contraptions [2] This power misfortune can be limited by repaying the responsive influence utilizing the compensators. The compensator picked in the paper is Static Synchronous Compensator (STATCOM)[4] as it has a quicker reaction of the request of  $\frac{1}{2}$  cycle and has better V-I qualities when contrasted with SVCs.[3] STATCOM is shunt associated control electronic gadget which is associated at the mid-purpose of the transmission line through coupling transformer [5] The STATCOM can give both genuine and responsive power support to the transmission line.[7]The transmission line voltage is ventured down to 415 volt and is associated with non-direct loads are considered for investigation. [21] The STATCOM produces an AC voltage, which thus causes a current of variable greatness at the purpose of association with the transmission framework. This infused current is nearly in quadrature with the line voltage, consequently copying an inductive or a capacitive reactance at the purpose of association with the transmission line [6] and gives the required genuine or receptive power remuneration [8]. This strategy can be utilized to enhance the power quality and blame ride-through ability of a windfarm [20] [23].

## II. SYSTEM DESIGN

As appeared in Fig.2 A 33kV network is associated with the R heap of 100 KW through a medium  $\pi$  transmission line of length 100km. The RL parameters of the transmission line are  $R=2\omega$  and  $L=20mH$ . A moment heap of same rating is associated with the transmission line through an electrical switch for brief term of 0.2 to 0.4sec.

Parameters:

Source 33KV grid of Supply frequency 50Hz with zero Grid reactive Power,load connected is 100 KW of transmission length 100Km of 5 KV Vdc

### III. SYSTEM DESCRIPTION

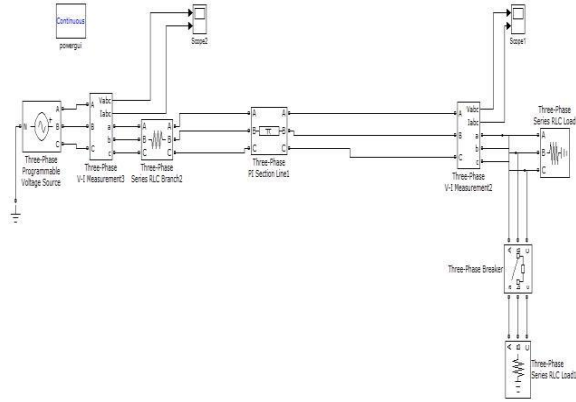
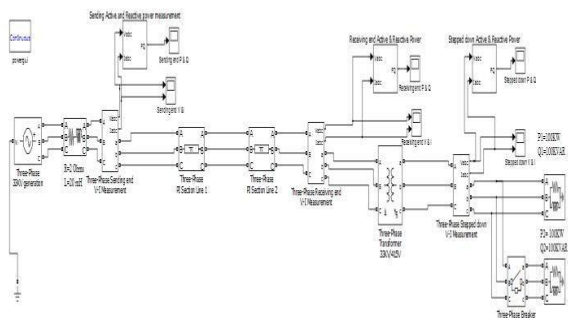


Fig.1 Simulink model of power system

As appeared in Fig.2 A 33kV network is associated with the R heap of 100 KW through a medium  $\pi$  transmission line of length 100km. The RL parameters of the transmission line are  $R=2\omega$  and  $L=20mH$ . A moment heap of same rating is associated with the transmission line through an electrical switch for brief term of 0.2 to 0.4sec.

An additional heap of a similar rating is included parallel with the heap that is now present as appeared in Fig.2 The additional heap is associated with the line through an electrical switch. The breakercondition is at first open and the end time of the electrical switch is given between 0.2 to 0.4 seconds, so just amid that time the additional heap will be added to the circuit. Because of the expansion of the additional heap the current drawn by the heap will be all the more, so voltage droop happens just at the time between 0.2 to 0.4 seconds which is seen in the waveform appeared in Fig.4.

Fig 2 Transmission line without STATCOM



The circuit for list remuneration utilizing STATCOM comprises of  $3\phi$  inverter of  $180^\circ$  conduction mode and the circuit for hang condition. The  $3\phi$  inverter yield is associated with the transmission line and the activity of the STATCOM is regulated by a control unit

Fig.3 Output waveforms of list condition in transmission line

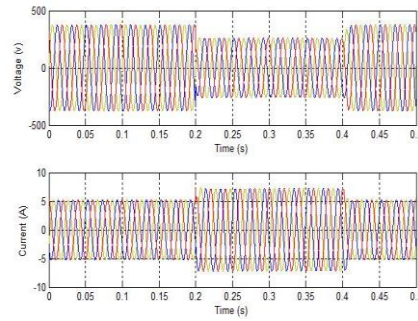


Fig.3 demonstrates the heap voltage of the framework. It can be seen that amid the list time frame, the voltage remuneration has been performed by the STATCOM.The circuit chart in Fig.8 demonstrates that the expansion of STATCOM for voltage hang pay. It comprises of ordinary transmission line circuit with droop condition in it and a STATCOM circuit for the programmed hang pay

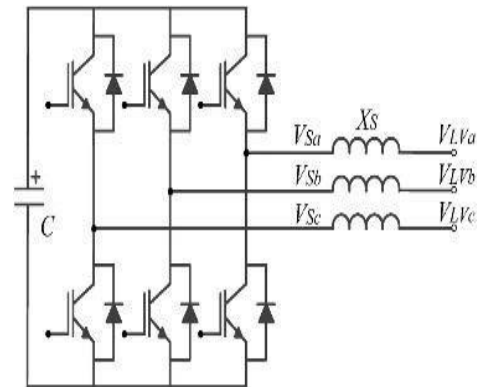


Fig 4 STATCOM Circuit

STATCOM is a shunt associated responsive - control pay gadget which is equipped for producing or potentially retaining receptive power and in which the yield can be changed to control the particular parameters of an electric power framework. It is a general strong state exchanging converter fit for creating or engrossing freely controllable genuine and receptive power at its yield terminals. Uniquely, the STATCOM considered is a voltage source converter that structures the given contribution of DC voltage, creates an

arrangement of 3 stage AC framework yield voltages, each in stage with the comparing AC framework voltage and combined with it through a moderately little reactance. The DC voltage is given by a vitality stockpiling capacitor.

Fig.4 demonstrates the 3φ inverter in 180° conduction mode, every transistor conducts for a time of 180°. Three transistors stay on at any moment of time. No two switches on a similar leg can direct in the meantime. The yield waveforms of 3φ 180° inverter conduction mode are appeared in Fig.7. It is a six-advance yield waveform.

Since they have a control unit the STATCOM circuit will be added to the circuit just if voltage list happens. So STATCOM gives shunt remuneration to the list just at the time it happens. The DC source utilized for 3φ inverter is a 415V source

IV. SIMULATION

The control circuit appeared in Fig.9 comprises of 3 stage PLL which produce the sine and cosine signals which gives the speed of the pivoting reference outline which is utilized for locking between the diverse waveforms. The yield voltage from stack and the information voltage are first changed over into coordinate hub, quadrature hub and zero arrangement parts, and after that the changed over yield voltage and information voltage is thought about in a comparator, the yield of the comparator is a blunder flag which is only the droop. At that point the mistake flag is changed over to 3φ utilizing dq0 to abc Park's change and after that the yield is given to PWM generator, in which the information flag is contrasted and the bearer flag whose recurrence is determined inside the square and afterward finally the beats are produced. The produced beats are given to the widespread scaffold which is only a 6-beat converter and in this way the switches in the VSC of the STATCOM are activated, and the DC control is changed over to 3 stage AC power and it is given to the transmission line so as to remunerate the droop

Fig.5 demonstrates the remunerating voltage and current provided by the STATCOM.

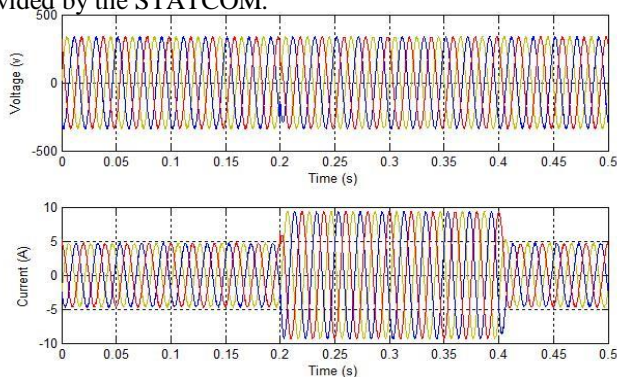


Fig. 5 Compensated system voltage and current

V. CONCLUSION

In this paper, investigation of remuneration of the transmission line is done and infusion of the genuine or responsive power when required utilizing STATCOM has been performed. It has been watched that STATCOM guarantees the consistent supply of steady voltage from the source to the collector all through the transmission line. A reasonable control unit which goes about as an input system has been intended to guarantee the best possible task of STATCOM to repay the voltage hang made because of the sudden expansion of an additional heap.

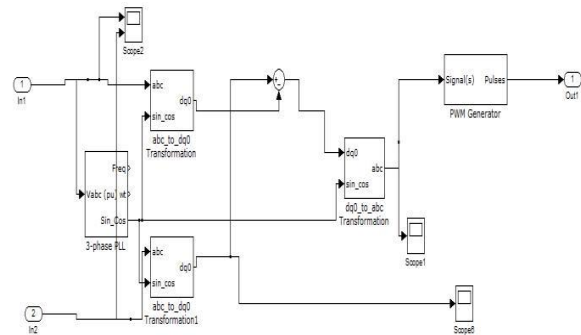


Fig 6 STATCOM simulink model

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