Power Quality Improvement of 33-Bus Distribution System using DSSC

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Abstract: This paper manages displaying and reenactment of Thirty Three Bus Distribution System (TTBDS) utilizing a DSSC. DSSC comprises of a DC source, inverter and infusion transformer. The DSSC is fit for improving the voltage profile of appropriation framework by infusing a voltage in arrangement with the line. Four number of DSSCs are proposed for TTBDS to improve the voltage profile. The TTBD Systems with and without DSSC are demonstrated, recreated and their outcomes are introduced. The outcomes demonstrate that the voltage profile is improved by utilizing DSSC. [19],[20],[21]

Keywords : Unified power flow control (UPFC), Distributed static series compensator (DSSC), Flexible AC Transmission System (FACTS), Voltage Ampere Reactive (VAR), Dynamic Voltage Regulator (DVR), Static Compensator (STATCOM).

I. INTRODUCTION

Over the trendy couple of a long time, the standard stresses of the strength affiliations are about strength nice troubles. the short evaluate which both the intrigue and delivery of electrical power impact at the presentation of electrical contraption is referred to as power pleasant. From the purchaser perspective, any issue arise approximately modern, voltage or the repetitive deviation that outcomes in electricity sadness is called control pleasant issues. The power great development typically affect by way of the strength instruments used by customers and used in statistics devices.

maximum real hazards for volatile rigging in electrical systems are voltage hangs (voltage dive) and swells (over voltage) [5]. those worrying impacts happen by means of beliefs of express activities, e.g., bog down the shape, inrush streams associated with the begin of giant machines, or buying and selling assignments the cross section on this paper, a allotted static strategy compensator, displayed in as every other records contraption, is used to ease voltage and contemporary waveform deviation and enhance manipulate quality in not extra than seconds. The DSSC shape is gotten from the UPFC shape this is joined one converter and some immaterial loose route of motion converters, as confirmed up in Fig.1.1 [6][4]. The converter takes after the STATCOM even as the method converter uses the D-records thought. The DSSC has same point of confinement as UPFC to modify the

road parameters, i.e., line impedance, transmission part, and transport voltage size.[4]

Figure-1: DSSC structure

II. DSSC PRINCIPLE

inside the Unified strength drift Controller (UPFC) is made from SSSC and STATCOM. both are coupled by means of DC hiding away capacitor through techniques for a customary DC interface.. Speculatively the 0.33, 6th, and ninth consonant repeat can be used to trade dynamic energy the DSSC, that are commonly zero course of action frequencies.. In putting on this the third sounds repeat is picked that's most immaterial zero get-collectively symphonious repeat. in the going with subsections; the DSSC imperative contemplations are defined. [14],[16], [18]

Since the key of unequivocal terms with different frequencies are zero, so the dynamic power condition is given as:

$$P = \sum_{n=1}^{\infty} V_n I_n \cos \phi_n \quad (1)$$

where V_n and I_n are the voltage and contemporary on the n th harmonic, solely, and ϕ_n is the point between the voltage and cutting-edge at a comparative repeat. situation (1) gives the dynamic strength at one of a kind repetitive elements is self-choice. From the above condition (1),

the modern and voltage in a single repeat has no impact at the dynamic electricity at numerous frequencies. [13], [15] .[17]

The dynamic strength at specific frequencies is limited

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from every different. So via this idea the converter in DSSC can ingest dynamic strength from the framework on the focal repeat and inject the contemporary yet into the move sector at a symphonious repeat.

In setting on this truth, a converter in DSSC can maintain the dynamic electricity in a single repeat and passes on yield manipulate in some other repeat, and moreover as confirmed up via the degree of dynamic power required on the principal repeat, the DSSC technique converter make the voltage at the symphonious repeat there by way of attracting the dynamic strength from consonant components. [8],[10],[12]

because the technique converters of the DSSC are single-kind out, it offers the DSSC the opportunity to govern contemporary in each stage overtly, which confirms that both terrible and zero social occasion clashing current may be examined. additional controllers are progressed to the modern DSSC controller. Their manage trendy is to display the poor and 0 groupings present day through the transmission line and to constrain them to 0.

Figure-2.: Active Power Exchange

The above literature does not use DSSC for distribution systems. This work proposes DSSC for TTBS. The comparison of performance of TTBS with and without DSSC is not reported in the previous papers.

III.SYSTEM DESCRIPTION

Proposed circuit Diagram of DSSC is appeared in Fig 1.3. 33 Bus system is shown in Fig 1.4.

Figure 3 Proposed circuit Diagram of DSSC

Figure 4 33-Buses System of block diagram

IV. SIMULATION RESULTS

Circuit diagram of 33-bus system without DSSC is appeared in Fig 2.1.

Fig 5 Circuit diagram of 33-bus system without DSSC

Fig 6 Voltage at bus-5

Voltage at bus-5 is appeared in Fig 2.2 and its gain is 5000V. Real power and reactive power at

bus-5 are appeared in Figs 2.3 and its value of real power is 1.17×10^5 MW and its value of reactive power is 2.3×10^4 MVAR. Without DSSC after 0.4sec second load will be on voltage, real and reactive power decreased. [7],[9],[11]

Fig 7 Real power and reactive power at bus-5

Fig 8 Voltage at bus-26

Real power and reactive power at bus-26 are appeared in Figs 2.5 and its value of real power is 14×10^4 MW and its value of reactive power is 4.4×10^4 MVAR. Without DSSC after 0.4sec second load will be on real and reactive increased

Fig 9 Real and reactive power at bus-26

Fig 10 voltage at bus-32

Fig 11 Real and reactive power at bus-32

Fig 12 Circuit diagram of 33-bus system with DSSC is appeared in Fig 12

Fig 13 Circuit diagram of 33-bus system with DSSC

Voltage at bus-5 is appeared in Fig 2.9 and its value is 5000V. With DSSC after 0.4sec second load will be on voltage as increased.

Fig 14 Voltage at bus-5

Real power and reactive power at bus-5 are appeared in Figs 2.10 and its value of real power is 2.1×10^5 MW and its value of reactive power is 2.8×10^4 MVAR. With DSSC after 0.4sec second load will be on real and reactive power increased. [2],[4],[6]

Fig 15 Real and reactive power at bus-5

Motor torque at bus-14 is appeared in Fig 2.12 and its value is 99 N-m.

Fig 16 Motor torque at bus-14

Voltage at bus-26 is appeared in Fig 2.13 and its value is 5000V. With DSSC after 0.4sec second load will be on voltage as increased.

Fig 17 voltage at bus-26

Real power and reactive power at bus-26 are appeared in Figs 2.14 and its value of real power is 2×10^5 MW and its value of reactive power is 6.3×10^4 MVAR. With DSSC after 0.4sec second load will be on real and reactive power increased. [1],[3],[5]

Fig 18 Real and reactive power at bus-26

Motor speed at bus-30 is appeared in Fig 2.15 and its value is 1500 RPM.

Fig 19 Motor speed at bus-30

Motor torque at bus-30 through is appeared in Fig 2.16 and its value is 22 N-m.

Fig. 20 Motor torque at bus-30

Voltage at bus-32 is appeared in Fig 2.17 and its value is 6300 V. With DSSC after 0.4sec second load will be on voltage as increased.

Fig 21 Voltage at bus-32

Real power and reactive power at bus-32 are appeared in Fig 2.18 and its value of real power is 12×10^5 MW and its value of reactive power is 5.5×10^5 MVAR. With DSSC after 0.4sec second load will be on real and reactive power increased.

Bus Voltage of without and with DSSC is given in Table-1. DSSC without and with voltage Bus-5 value is 4.55 to 5.51KV. The Bus 26 without and with voltage value is 4.20 to 5.15 KV. The Bus 32 without and with voltage value is 5.26 to 6.20 KV.

TABLE-1 VOLTAGE OF WITHOUT AND WITH DSSC

BUS NO	VOLTAGE WITHOUT DSSC (KV)	VOLTAGE WITH DSSC(KV)
BUS-5	4.55	5.51
BUS-26	4.20	5.15
BUS-32	5.26	6.20

TABLE-2 REAL AND REACTIVE POWER OF WITHOUT AND WITH DPFC

BUS NO	Real power (MW) Without DSSC	Real power (MW) With DSSC	Reactive power (MVAR) Without DSSC	Reactive power (MVAR) With DSSC
BUS -5	0.170	0.215	0.024	0.028
BUS -26	0.151	0.210	0.042	0.062
BUS -33	0.623	1.120	0.165	0.540

V. CONCLUSION

TTBS with and without DSSC are simulated. The results indicate that the voltage, real power and reactive power are improved by the addition of DSSC. The increase in V,P and Q are due to increase in voltage with the addition of DSSC. DSSC has the ability to compensate the voltage sag in power and distribution lines. The disadvantage of DSSC is that the hardware cost is increased.

The present work deals with TTBS with and without DSSC. Studies on closed loop TTBS with PI and PR systems will be done in future.

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