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Performance Analysis of Eleven Bus System

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Abstract: ***This paper present performance of fed Eleven bus power system and UPFC system. We are modeled and simulate using Matlab/Simulink. The performance analysis of voltage sag and voltage swell in the Eleven bus uncompensated system. In this paper UPFC has been developed using shunt and series device. It is the capable of improving transient stability of power system. UPFC is control the flow of real and reactive power by voltage in series with the transmission line. In this paper we determine Load voltage; load current, real and reactive power waveforms show UPFC results. In a recent time many research paper are working in fourteen bus system, Five bus system and many more but now in this paper we perform analysis of Eleven bus system.***

Keywords: UPFC, Power quality, compensation, converter and Matlab simulink.

1. Introduction

The demand of efficient and high quality power is escalating in the world of electricity. Today's power systems are highly complex and require suitable design of new effective and reliable devices in deregulated electric power industry for flexible power flow control[1]. The objective of this paper is to study the reduction in the harmonics of injected voltage by using a multilevel inverter. Eleven bus system without UPFC is modeled and simulated using the blocks of simulink. There are 11 loads and 7 generators. Eleven bus system performance of voltage sag and swell uncompensation system. The power-transfer capability of long transmission lines are usually limited by large signals ability. Economic factors, such as the high cost of long lines and revenue from the delivery of additional power, give strong incentives to explore all economically and technically feasible means of raising the stability limit. The FACTS devices enhance the stability of the power system with its fast control characteristics and continuous compensating capability. The controlling of the power flow and increasing the transmission capacity of the existing transmission lines are the two main objectives of FACTS technology. Thus, the utilization of the existing power system comes into optimal condition and the controllability of the power system is increased with these objectives. Gyugyi proposed the Unified Power Flow Controller which is the new type generation of FACTS devices in the year 1991. The unified power-flow controller (UPFC) is a member of the FACTS family with very attractive features. This device can independently control many parameter, since it has the combined properties of a static synchronous compensator (STATCOM) and static synchronous series compensator (SSSC)[2]. The UPFC parameters can be controlled in order to achieve the maximal desired effect in solving first swing stability problem. This problem appears for bulky power systems with long transmission lines[3]. Power Flow through an alternative current line is a function of the line impedance, the magnitude of the sending-end and receiving-end voltage and the phase angle between these voltages. The power flow can be increased, firstly by decreasing the line impedance with a capacitive reactance, secondly by increasing the voltages and finally by increasing the phase angle between these voltages. The FACTS controllers have been broadly developed on two different principles, one that alters the line series reactance or bus shunt reactance or voltage phase difference across a line and utilizes conventional thyristor switches for control. In general, FACTS controllers can be divided into four categories based on their connection in the network, viz., series, shunt, combined series-series, and combined series-shunt.

2. Operating Principle of UPFC

The UPFC consists of two voltage source converters namely series and shunt converter, which are connected to each other with a common DC link. Static Synchronous Series Compensator (SSSC) is used to add controlled voltage magnitude and phase angle in series with the line. Shunt converter or Static Synchronous Compensator (STATCOM) is used to provide reactive power to the AC system. Besides that it will provide the DC power required for both the converters. Each of the branches consists of a transformer and power electronic converter. The two voltage source converters share a common DC capacitor. The energy storing capacity of this DC capacitor is generally low. Therefore, active power drawn by shunt converter should be equal to the active power generated by the series converter. The reactive power in the shunt or series converter can be chosen independently, giving greater flexibility to the power flow control. The coupling transformers are used to connect the converters to the transmission system. The UPFC can be used to control the flow of active and reactive power through the transmission line and to control the amount of reactive power supplied to the transmission line at the point of installation . The series inverter is controlled to inject a symmetrical three phase voltage system of controllable magnitude and phase angle in series with the line to control active and reactive power flows on the transmission line. So, this inverter will exchange active and reactive power with the line.

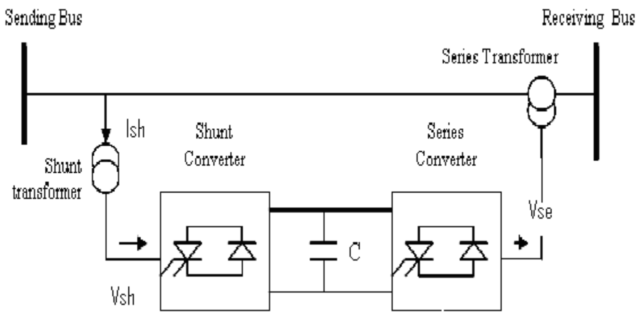

Figure1: Schematic diagram

3. Objectives

The study of the existing research, the present paper has been undertaken with the following objectives:

- To study the Eleven bus system of power system.
- To study of UPFC system
- To make the model of Eleven bus system and UPFC system analysis the MATLAB simulation.

4. Simulation Results

Eleven Bus system Simulink Model is shown in Fig 2. Each transmission line represented by impedence. Generators are modeled as practical voltage sources of ratings 4.5kVVrms, 50 Hz. The impedance connected as loads at all PQ buses. Eleven bus uncompensated system shown in Fig 3.

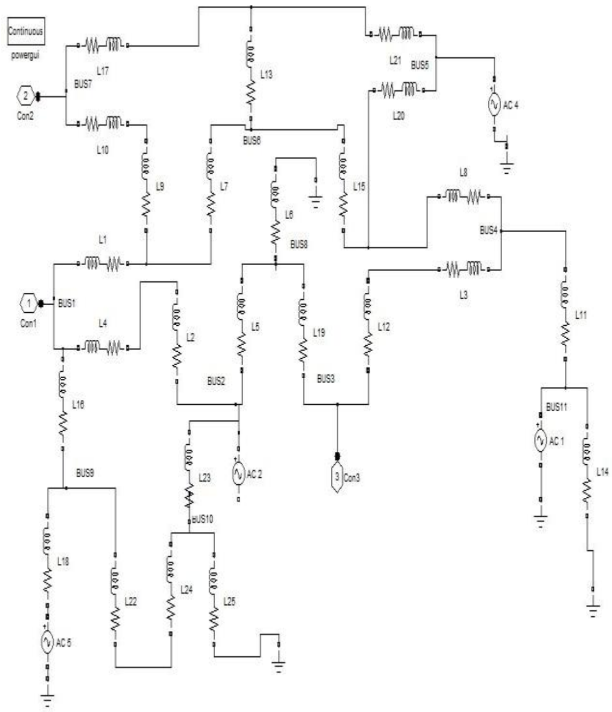

Figure 2: Simulink Model of Eleven Bus System

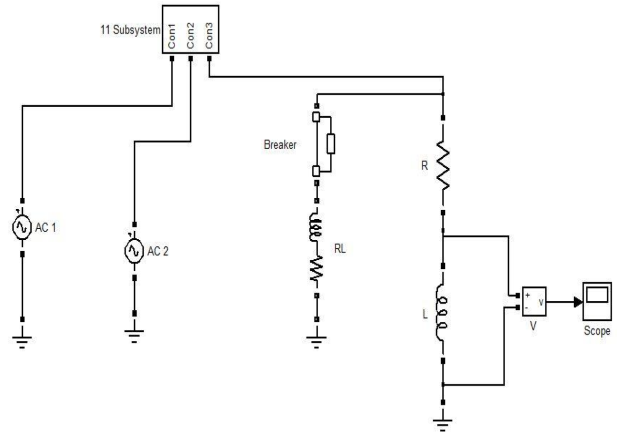

Figure 3: Eleven bus uncompensated system

4.1Table for voltage/Sample time(V/T_s)

Table 1

S. No.	Connections	Parameter used V	Ts	Effect
1.	For connection 1	50	10	When voltage increase Sample time also increase
		100	20	
		150	30	
		200	40	

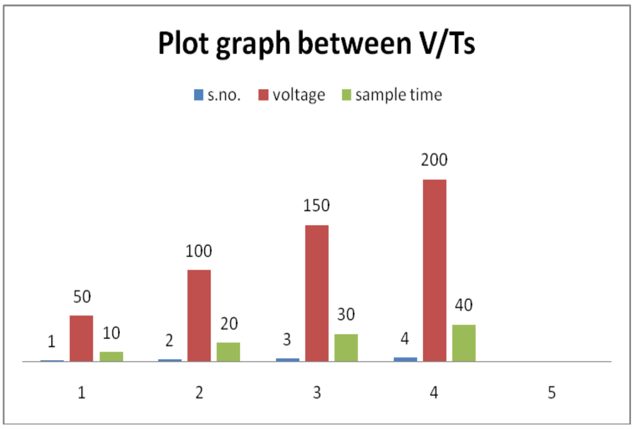

Figure3a

Table 2

S. no.	connection	Parameter used		Effect
		V	T_s	
1.	For Connection 2	300	50	When voltage increase but sample time properly not increase
		350	60	
		400	70	
		450	80	

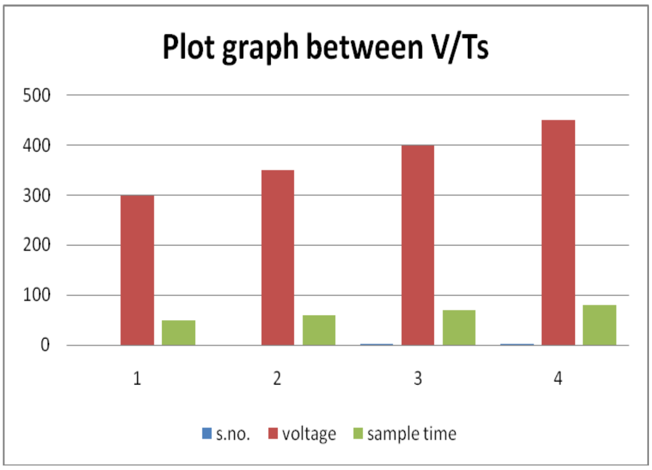

Figure3b

Table 3

S. no.	connection	Parameter used	Effect
1.	For Connection 3		
	When the breaker open	R_L=30,0.010	Amplitude low
		R=20	
		L=0.05	
2.	When the breaker closed	R_L=200,0.020	Amplitude high
		R=100	
		L=0.010	

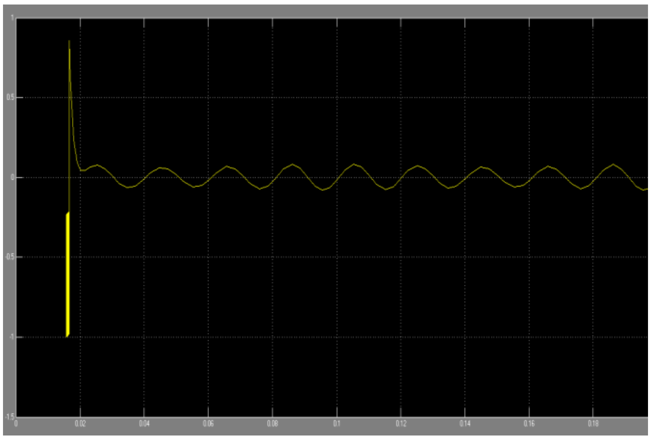

Figure 3c: when beaker is open

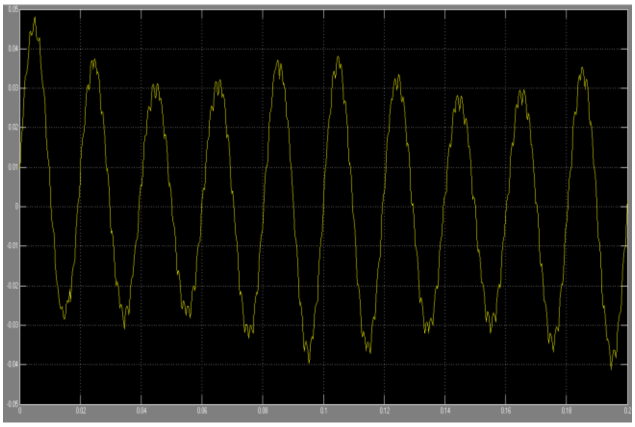

Figure 3d: When breaker is closed

UPFC

The UPFC is to control the flow of real and reactive power by injection of a voltage in series with the transmission line. Both the magnitude and phase angle of the voltage can be varied independently. The real and reactive power flow in the line can be controlled using series injected voltage. A simulink model of the UPFC has been developed shunt and series sources. converter 1 represented as a shunt current source and converter 2 represented as a series voltage source shown in Fig.4. Load voltage and load current Waveforms shown in Fig. 4a.Real and reactive power shown in Fig. 4b.

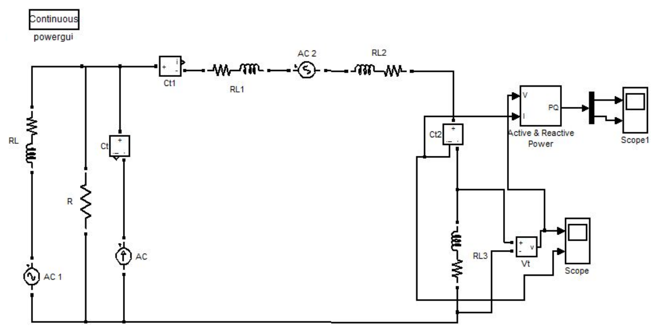

Figure 4: Simulink model of UPFC Shunt and Series sources

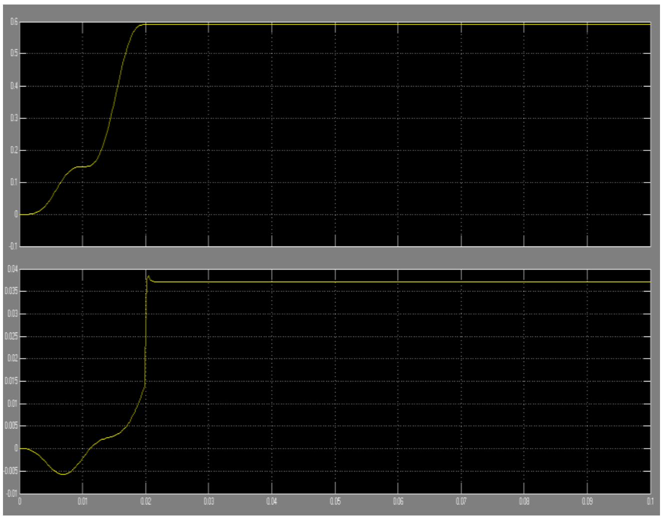

Figure 4a: Real and reactive power

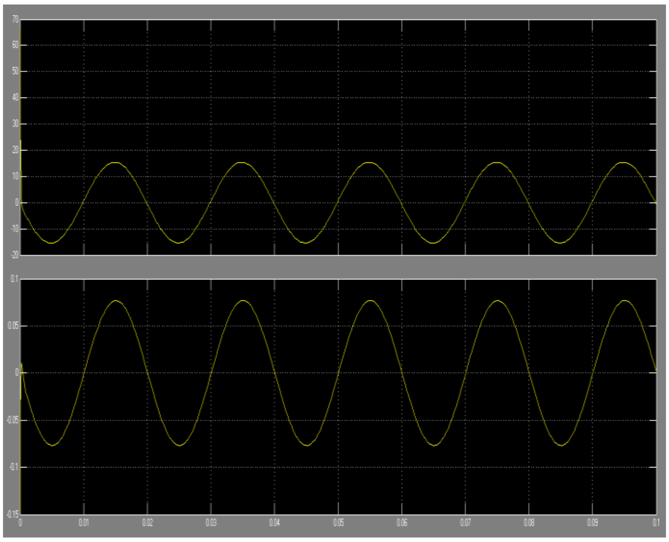

Figure 4b: Load voltage and current waveform

5. Conclusion

In this paper, the performance of Eleven bus system and UPFC system. We has been present uncompensated Eleven bus system different condition of between voltage and sample time. This system voltage increase then also sample time increase. when breaker is open then amplitude is low and breaker is close then amplitude is high in this system. Simulink model of UPFC series and shunt sources shown real power, reactive power, load voltage and current waveforms. Eleven bus system are economical for fourteen, nine bus system because Eleven bus system results are good for other bus system .In figure 3a voltage is high in particular time after amplitude is low and figure 3b amplitude is high but some distortion of the point.

References

[1] Arup Ratan Bhowmik , Champa Nandi "*Implementation of Unified power Flow controller (UPFC) for Power Quality Improvement in IEEE 14- Bus system*" Vol 2 (6), 1889-1896.

[2] S. Muthukrishnan, Dr. A. Nirmalkumar & G. Murugananth "*Modelling and Simulation Five Level Inverter based UPFC System*" vol.12-No.11,January 2011.

[3] S. Muthukrishnan, A. Nirmalkumar "*Comparison and Simulation of Open Loop System and Closed Loop System Based UPFC used for Power Quality Improvement*" Volume-1, Issue-6, January 2012.

[4] S. Muthukrishnan & Dr. A. Nirmalkumar "*Comparison of Simulation and Experimental Results of UPFC used for Power Quality Improvement*"vol.2,No.3,June,2010.

[5] Amlan Barik & Sidharth Sabyasachi *"Control Design and Comparison of Unified Power Flow controller for various Control Strategies*" ISSN:2277-3878,Volume-3,Issue-1,March2014.

[6] Gabriela Glanzmann "Flexible Alternating Current Transmission Systems" January 2005.

[7] B.Gopinath , S.Suresh Kumar & Juvan Michael *"Unified Power Flow Controller (UPFC) Dynamic Stability in Power System Using Modern Control Techniques"* ISSN:2249-8958,volume-2,Issue-4,April2013.

[8] C.D. Schaulder et al., *"Operation of unified power flow controller (UPFC) under practical constraints"* IEEE Trans.Power Del., vol.13, no.2. pp.630-639, Apr1998.

[9] R.Mihalic et al., *"Improvement of transient stability using unified power flow controller"* IEEE Trans.Power Del., vol. 11, no. 1, pp. 485-492, Jan 1996 .

[10] J.Machowski et al., "*Power System Dynamics and Stability"*. New York: Wiley, 1998.

[11] M. Noroozian et al., *" Improving power system dynamics by series-connected FACTS devices,"* IEEE trans. Power Del., vol. 139, no.4, pp. 689-694, Oct. 1997.

[12] B. Venkata Ramana, K.V.S.R. Murthy, P.Upendra Kumar, V. Raja Kumar "A Two Bus Equivalent Method for Determination of Steady State Voltage Stability Limit of a Power System," ISSN: 2250-3005.

[13] Nashiren.F. Mailah, Senan M .Bashi "Single Phase Unified Power Flow Controller (UPFC):Simulation and Construction," ISSN 1450-216X Vol.30 NO.4(2009),pp.677-684.

[14] Vaibhav S kale, Prashant R Patil, Ravi Khatri "Unified Power Flow Controller for Power Quality Improvement," ISSN:2319-6378,Volume-1, Issue-10, August 2013.

[15] Subhash Chander Swami, Anurag pandey "Real and Reactive Power Flow Analysis & Simulation with UPFC Connected to a Transmission Line," ISSN:2319-7064.

[16] B.A.Renz, A.Keri, A.S.Mehraban, C.Schauder, E.Stacey, L.kovalsky, L.Gyugyi, A. Edris "AEP Unified Power Flow Controller Performance," IEEE Transactions on Power Delivery, Vol. 14, No. 4, October 1999.

[17] Zhengyu Huang, Yixin Ni, C.M. Shen, Felix F. Wu, Shousun Chen, and Baolin Zhang "Application of Unified Power Flow Controller in Interconnected Power Systems-Modeling, Interface, Control Strategy, and Case Study," IEEE Transactions on Power Systems, Vol. 15, No. 2, MAY 2000.

[18] J. Guo, Student Member, IEEE, M.L. Crow, Senior Member, IEEE, and Jagannathan Sarangapani, Senior Member, IEEE "An Improved UPFC Control for Oscillation Damping," IEEE Transations on Power Systems, Vol. 24, No.1, FEBRUARY 2009.

[19] Salim. Haddad, A. Haddouche, and H. Bouyeda "The use of Facts devices in disturbed Power Systems-Modeling, Interface , and Case Study," Vol. 1, No. 1, April 2009.

[20] Dakka. Obulesu, Dr. S.F. Kodad, Dr. B.V. Sankar Ram "GAPOD and GA DC- voltage regulator based UPFC supplementary controller for damping low frequency oscillations in Multi-Machine Power systems," Volume-02, Issue-08, pp-12-23.

[21] Sandeep Kaur, Amarbir Singh, Dr.Raja Singh Khela, "Load Flow Analysis of IEEE-3 bus system by using Mipower Software," ISSN:2278-0181 Vol.4 Issue 03, March-2015.