

A Literature Review on Experimental Study of Power Losses in Transmission Line Using UPFC Device

¹Akanksha Shrivastava, ²Dr. A.K.Sharma, ³Mr. Ashish Choubey

¹Research scholar, ²Professor & HOD, ³Assistant Professor

¹Fourth Semester ME (High Voltage), Jabalpur Engineering College, Jabalpur (M.P) 482011, India

^{2,3}Department of Electrical Engineering, Jabalpur Engineering College, Jabalpur (M.P) 482011, India

Abstract: The flexible AC transmission system (FACTS) controllers can play an important role in the power system security enhancement. However, due to high capital investment, it is necessary to locate these controllers optimally in the power system. FACTS devices can regulate the active and reactive power control as well as adaptive to voltage-magnitude control simultaneously because of their flexibility and fast control characteristics. Placement of these devices in suitable location can lead to control in line flow and maintain bus voltages in desired level and so improve voltage stability margins.

In the previous paper three type of FACTS devices used in transmission lines for improvement of voltage profile in the power system. This paper describes the simulation result of flexible Alternative Current Transmission Systems (FACTS) devices used in the disturbed power systems. Out of three types of FACTS device UPFC performances is considered to be best comparatively with respect to each of the three devices.

Keywords: Voltage Stability, FACTS Devices, UPFC.

1. INTRODUCTION

The power electronic based flexible AC transmission systems (FACTS) have been developed and used as economical and efficient means to control the power transfer in the interconnected AC transmission systems. This allows forcing the power transit in the lines with higher transmission capacity. Among the FACTS components, Unified Power Flow Controller (UPFC), is the most complete. It is able to control independently the throughput active and reactive powers.

The UPFC is capable to act over three basic electrical system parameters [4]: line voltage, line impedance, and phase angle, which determine the transmitted power. 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 [4]. 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.

2. LITERATURE REVIEW

Ch. Rambabu et. al (2011)- Modern power system are prone to widespread failure. With the increase in power demand, operation and planning of large interconnected power system are becoming more and more complex, so power system will become less secure. Operating environment conventional planning and operating methods can leave power system exposed to instabilities.

Voltage instability is one of the phenomena which have result in a major blackout. Moreover, with the fast development of restructuring, the problem of voltage stability has become a major concern in deregulated power system. To maintain security of such system, it is desirable to plan suitable measures to improve power system security and increase voltage stability margin. FACTS devices can regulate the active and reactive power control as well as adaptive to voltage – magnitude control simultaneously because of their flexibility and fast control characteristic. Placement of these devices in suitable location can lead to control in line flow and maintain bus voltages in desired level and so improve voltage stability margins.

TCSC can change line reactance and SVC can be used to control reactive power in network . UPFC is the most versatile member of FACTS devices family and can be applied in order to control all parameters (i.e. line impedance, bus voltage and phase angle). Power flow can be controlled and optimized by changing power system parameters using FACTS devices. So optimal choice and allocation of FACTS devices can result in suitable utilization in power system.

S. Muthukrishnan et al (2010)- The power- transfer capability of long transmission lines are usually limited by large signals ability. Economics 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. On the other hand, the development of effective ways to use transmission system at their maximum thermal capability has caught much research attention in recent years.

Fast progression in the field of power electronics has already started to influence the power industry. This is one direct outcome of the concept of flexible AC transmission system (FACTS) aspects, which has become feasible due to the improvement realized in power-electronic devices. In principle, the FACTS device could provide fast control of active and reactive power through a transmission line. The unified power -flow controller (UPFC) is a member of the FACTS family with very attractive features. This device can independently control many parameters, so it is the combination of the properties of a static synchronus compensator (STATCOM) and static synchronus series compensator (SSSC)

Prakash Burade et.al. (2012)- In this paper, a Unified Power Flow Controller (UPFC) is a FACTS device that can be control the power flow in transmission lines by injecting active and reactive in voltage components in series with the lines. The proposed methodologies are based on the use of line loading security Performance Index (sensitivity factors have been suggested in this paper for optimal placement of UPFC.

This method are computationally efficient PI sensitivity factors have been obtained with respect to change in two of the UPFC parameters viz., magnitude and phase angle of the injected voltage in the lines. The proposed methodologies are tested validated for locating UPFC in IEEE 30–bus system. AC based Optimal Power Flow (OPF) formulation has been suggested to determine the optimal PI values, after placement of UPFC based on the proposed sensitivity factors. Both AC and DC power flow approximations have been used to define the sensitivity factors and their results have been compared on IEEE 30-bus system.

J. Nikoukar et. Al (2007)- The introduction of flexible AC transmission system (FACTS) in a power system improves the stability, reduces the losses, reduces the cost of generation and also improves the loadability of the system. In the proposed work, a non-traditional optimization technique, genetic algorithm is used to optimize the varios process parameters involved of FACTS devices in a power system. The various parameters taken into consideration were the location of the device, their type and their rated values of the devices. The simulation was performed on a 30-bus modified IEEE power system with various types of FACTS controllers, modeled for steady state studies. The optimization results clearly indicate that introduction of FACTS devices in a right location increases the loadability of the system and genetic algorithm can be effectively used for this kind of optimization

3. CONCLUSION

This paper presents the control & performance of the UPFC used for power quality improvement through SIMULATION RESULT and Voltage compensation using UPFC are studied. It is found that there is an improvement in the real powers through the transmission line when UPFC is introduced. The UPFC system has the advantages like reduced maintenance and ability to control real powers.

From above conclusion we conclude that after simulation result of UPFC, the performances of UPFC can be test experimentally in the laboratory through experimental set up and control the real and reactive power of the system and maintain the voltage level.

REFERENCES

- [1] 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.
- [2] 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 .
- [3] .Machowski et al., Power System Dynamics and Stability. New York: Wiley, 1998.
- [4] 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.
- [5] Gyugyi, " Unified power-flow control concept for flexible AC transmission system," Proc. Inst. elect. Eng.C, vol. 139, no.4, pp. 323-331, Jul, 1992.
- [6] N.G. Hingorani and L. Gyugyi, Understanding FACTS. New York: IEEE Press, 2000.
- [7] E. Gholipour and S.Saadate, " A new method for improving transient stability of power systems by using UPFC," in Proc. European Power Electronics, Toulouse, France, Sep. 2003.
- [8] Z. Huang et al., "Application of UPFC in interconnected power systems- Modeling, interface, control strategy, and case study, " IEEE Trans. Power Syst., vol. 15, no. 2, pp. 817-824, May 2000.
- [9] K. Schoder, A. hasanovic, and A. feliachi, " Enhancing transient stability using fuzzy control scheme for the unified power flow controller (UPFC) within the power system toolbox (PST)," in proc. Midwest Symp. Circuits Systems, vol. 3, lansing, MI, Aug, 2000, pp. 1382-1385.
- [10] K. Sen and A.J.F. Keri, "Comparison of field results and digital simulation results of voltage-sourced converter-based FACTS controller," IEEE Trans. Power Del., vol. 18, no. 1, pp. 300-306, Jan. 2003.
- [11] F.D. Galiana, K. Almeida, M. Toussaint, J. Griffin, and D. Atanackovic: "Assessment and Control of the Impact of FACTS Devices on Power System Performance", IEEE Trans. Power Systems, Vol. 11, No. 4, Nov 1996
- [12] N.G. Hingurani, L. Gyugyi, Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems, IEEE Press, New York, 2000.
- [13] M. Noroozian, L. Angquist, M. Ghandhari, G. Anderson, "Improv-ing Power System Dynamics by Seriesconnected FACTS De-vices," IEEE Trans. on Power Delivery, Vol. 12, No.4, October 1997.
- [14] M. Noroozian, L. Angquist, M. Ghandhari, "Use of UPFC for Optimal Power Flow Control," IEEE Trans. on Power Delivery, Vo1.12, No.4, October 1997.
- [15] R. Billinton, M. Fotuhi-Firuzabad, O.S. Faried, S. Aboreshaid, "Impact of Unified Power Flow Controllers on Power System Reliability," IEEE Trans. on Power Systems, Vo1.15, No.1, February 2000.
- [16] J.A. Momoh, J. Zhu, G.D. Boswell, S. Hoffman, "Power System Security Enhancement by OPF with Phase Shifter," IEEE Trans. on Power Systems, Vol. 16, No.2, May 2001.