RESEARCHERID
THOMSON REUTERS

[Markam * *et al.*, 7(8): August, 2018]
IC™ Value: 3.00

ISSN: 2277-9655
Impact Factor: 5.164
CODEN: IJESS7

IJESRT

INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY

STABILITY ENHANCEMENT OF POWER TRANSMISSION USING UPFC WITH FUZZY LOGIC CONTROLLER

Vishnu Prasad Markam[*1] & Sanjeev Jarariya[2]

[*1]Research Scholar, Corporate Institute of Science and Technology, Bhopal

[2]Professor, Corporate Institute of Science and Technology, Bhopal

DOI: 10.5281/zenodo.1345680

ABSTRACT

In this paper research is carried on a long transmission line model compiled in the MATLAB for the enhancement of power with improved power factor and reduced harmonic distortion. UPFC (Unified Power Flow controller) which is a FACT gadget is utilized as a part of between the transmission line at the focal point of T demonstrate for pay. UPFC is a blend wander of SSSC and STATCOM and is controlled utilizing the usage of fluffy rationale controller and the outcomes demonstrates that power factor and different parameters were enhanced with less twisting.

Keywords: UPFC, FLC, FACT devices, MATLAB.

I. INRTODUCTION

Transient stability is the ability of power system to maintain synchronism when subjected to a severe disturbance, such as a fault on transmission facilities, sudden loss of generation, or loss of a large load. The system response to such disturbances involves large excursions of generator rotor angles, power flows, bus voltages, and other system variables. With the invent of Flexible Alternating Current Transmission(FACTS) devices based on power electronics, excellent operating experiences available world-wide, these devices are becoming more mature and more reliable to improve the performance of long distance AC transmission. FACTS controllers can be classified as (i) Variable impedance type controllers and (ii) Voltage source converter based controllers. This paper considered one of the FACTS devices UPFC. UPFC is the most versatile one that can be Used to enhance steady state stability, dynamic stability and transient stability. The UPFC is capable of both supplying and absorbing real and reactive power. Analysis of transient stability from with UPFC in

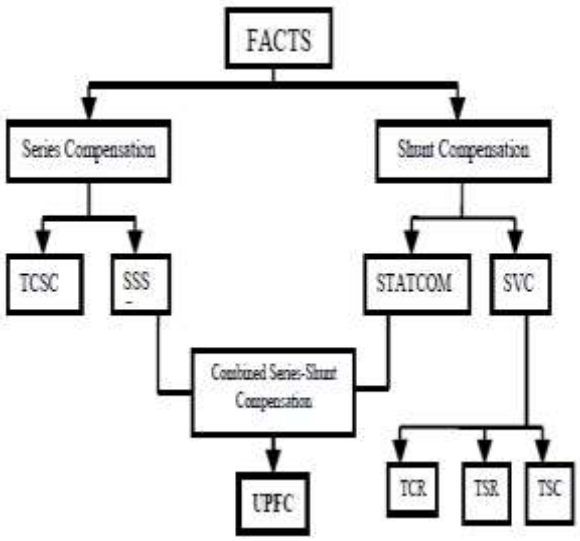

Fig 1.1 Understanding FACT devices from histogram

ISSN: 2277-9655
Impact Factor: 5.164
CODEN: IJESS7

MATLAB/SIMULINK WSCC model has been done. This paper considered three different conditions i.e. pre fault, with fault, and with UPFC (steady state, LLG fault, and after fault with UPFC).

II. CONTROL STRATEGY- UPFC

The Unified Power Flow Controller (UPFC) is the most versatile one that can be used to enhance steady state stability, dynamic stability and transient stability. The UPFC is capable of both supplying and absorbing real and reactive power and it consists of two ac/dc converters. One of the two converters is connected in series with the transmission line through a series transformer and the other in parallel with the line through a shunt transformer. The dc side of the two converters is connected through a common capacitor, which provides dc voltage for the converter operation. The power balance between the series and shunt converters is a prerequisite to maintain a constant voltage across the dc capacitor. As the series branch of the UPFC injects a voltage of variable magnitude and phase angle, it can exchange real power with the transmission line and thus improves the power flow capability of the line as well as its transient stability limit. The shunt converter exchanges a current of controllable magnitude and power factor angle with the power system. It is normally controlled to balance the real power absorbed from or injected into the power system by the series converter plus the losses by value [13]

III. UNIFIED POWER FLOW CONTROLLER

The Unified Power Flow Controller (UPFC) devised for the real-time control and dynamic compensation of ac transmission systems, providing multifunctional flexibility required to solve many of the problems facing the power delivery industry.The Unified Power Flow Controller (UPFC) consists of two voltage sourced converters, using gate turn-of (GTO) thyristor valves. These converters, labelled “Converter 1” and “Converter 2” in the figure 2.1, are operated from a common dc link provided by a dc storage capacitor. This arrangement functions as an ideal ac-to-ac power converter in which the real power can freely flow in either direction between the ac terminals of the two converters, and each converter can independently generate (or absorb) reactive power at its own ac output terminal [13].

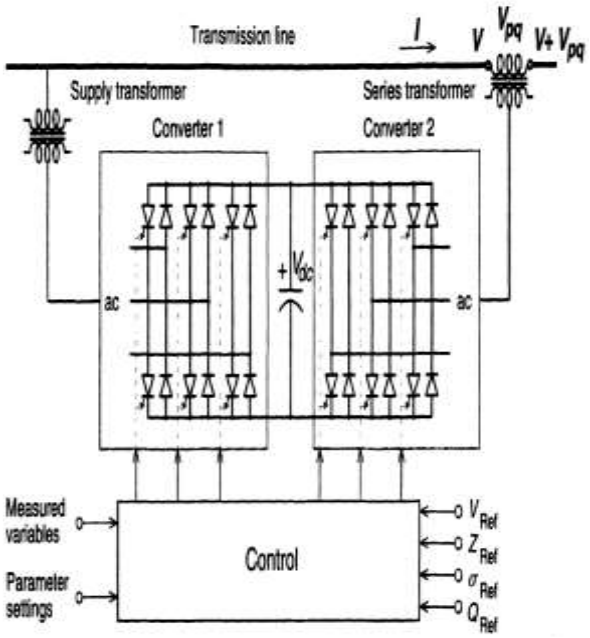

Fig 3.1 Unified power flow controller

Basic operating principle of upfc

The Unified Power Flow Controller (UPFC) was devised for the real-time control and dynamic compensation of ac transmission systems, providing multi-functional flexibility required to solve many of the problems facing the power delivery industry.

ISSN: 2277-9655
Impact Factor: 5.164
CODEN: IJESS7

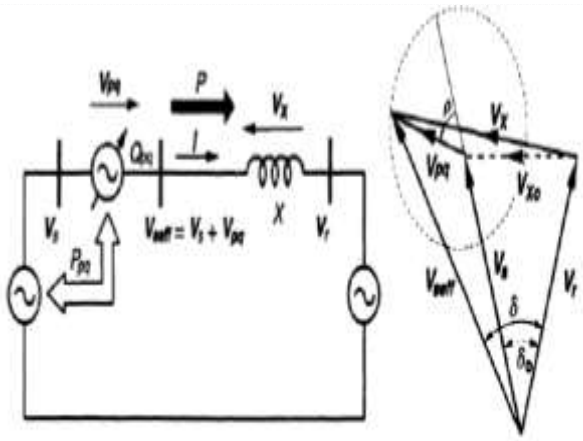

Fig 3.2 Conceptual representation of Unified Power flow Controller

IV. MATLAB SIMULATION MODEL

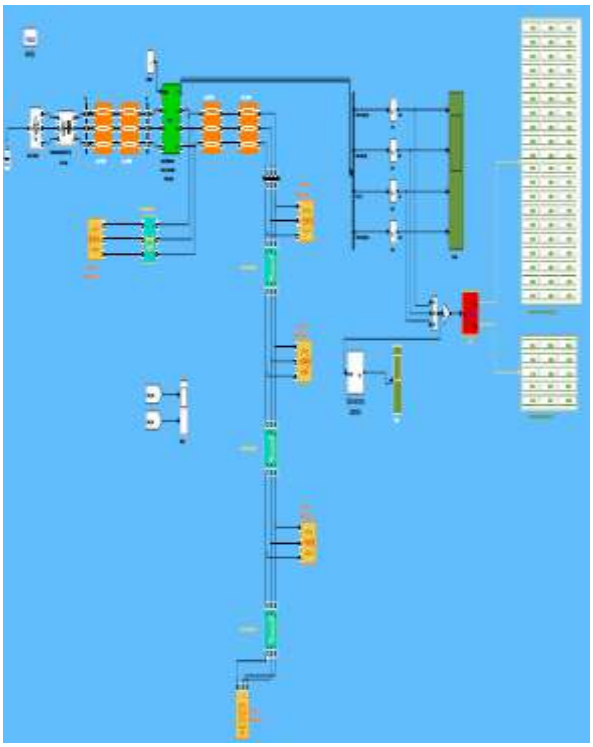

Fig 4.1 simulation model used for analysis

A 230 kV ,100 MVA source is taken for a long transmission line of 800 km. the line resistance per unit length is considered as [0.01273 0.3864] ohms/km [N*N matrix] or [R1 R0 R0m] in per unit, the line inductance per unit length is [0.9337e-3 4.1264e-3] H/km [N*N matrix] or [L1 L0 L0m] and the line capacitance per unit length is [12.74e-9 7.751e-9] F/km [N*N matrix] or [C1 C0 C0m] for each 200 km length. In this long transmission line parallel R-L-C load is connected which is introduced in different steps as no load, half load and full load. UPFC is introduced in the middle of the line as the most nominal place in the T model of installation strategy.

ISSN: 2277-9655
Impact Factor: 5.164
CODEN: IJESS7

V. RESULT ANALYSIS

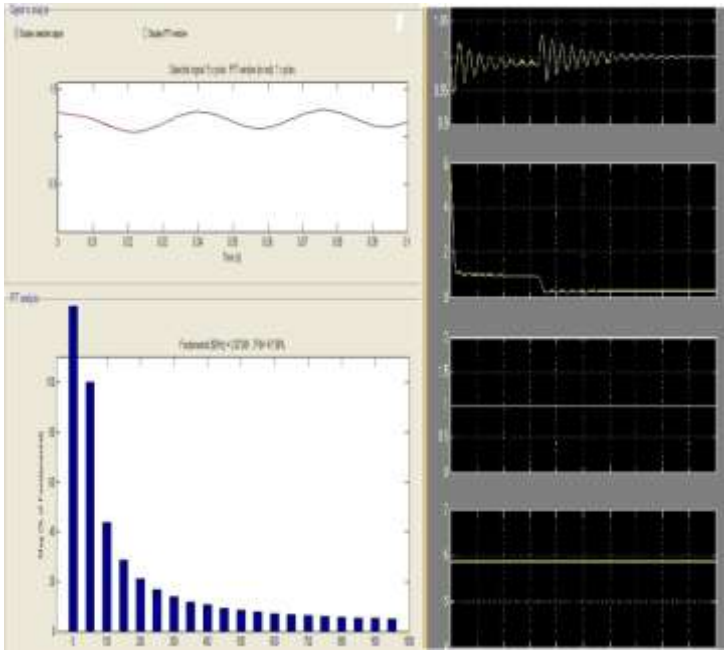

Fig 5.1 Results showing with UPFC PI controller

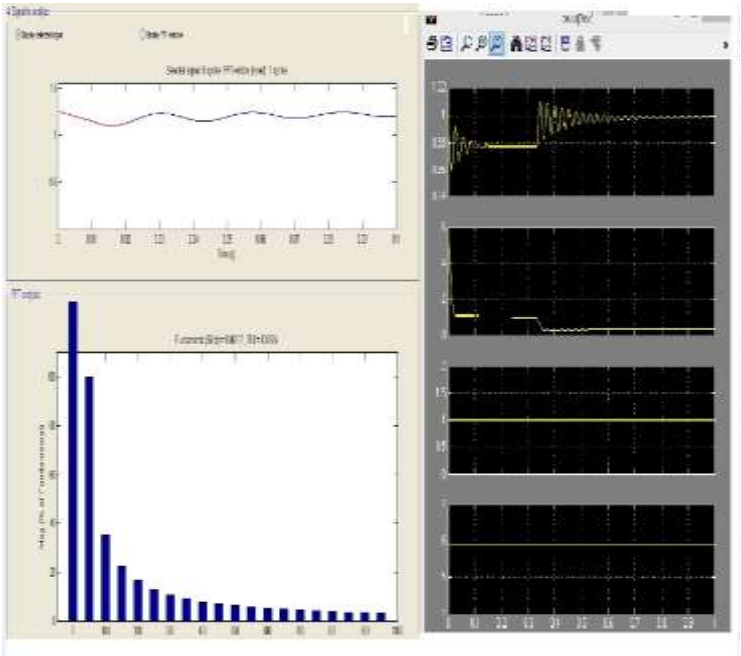

Fig 5.2 Results showing with UPFC fuzzy logic controller

VI. ANALYSIS

1. It can be clearly seen in fig 5.1 and 5.2 that the fast settlement of system is in fig 5.2 which is controlled by the approaches of fuzzy logic control. it shows the improvement of settling time parameter of time response as it increases damping ratio also.
2. In the total harmonic distortion window showing FFT analysis it is seen that previously the THD is reduced from 47.9 % to 43.67 %.THD is inversely propotional to power factor hence power factor is improved improving the transmission capacity of power with reduced losses/

ISSN: 2277-9655
Impact Factor: 5.164
CODEN: IJESS7

3. steady state error is improved
4. Overshoots are reduced.
5. Fast response of the system.

VII. CONCLUSION

For the transmission of power through long distance over the line it is transmitted in high ratings and due to which due to sudden load or generator side disturbances compensation is required for maintaining the complete system in synchronism. While compensation now it is required to have fast responses and immediate controlled actions which can be done by using intelligent system of controlling .in this paper the same is done as the implementation of fuzzy logics are used in controlling the UPFC and it is seen that harmonic distortions are improved with fast settlement of the system.

REFERENCES

[1] **PouyanPourbeik, Michael J. Gibbard's [May 1998]** analysis suggested by using the concept of induced torque coefficients developed in [7], a method is developed for the simultaneous coordination of power system stabilizers

[2] **Ibraheem, Prabhat Kumar and Dwarka P. Kothari [FEBRUARY 2005]** Have presented critical literature review and an up-to-date and exhaustive bibliography on the AGC of power systems.

[3] **Ashwani Sharma, Saurabh Chanana, and Sanjoy Parida** Have examined new methodology for combined optimal location of Thyristor Controlled Phase Angle Regulator (TCPAR) and Thyristor Controlled Series Compensator (TCSC) has been proposed using a mixed integer linear programming approach in the deregulated electricity environment.

[4] **.C. K. Panigrahi, Prof. P. K. Chattopadhyay, Prof. R.N. Chakrabarti [July 2005]** have suggested that the restructuring of the electric power industry has involved paradigm shifts in the real time control activities of the power grids.

[5] **Saurabh Chanana, and Ashwani Kumar [2006]**have analyzed that in a deregulated power industry, the real time pricing of real and reactive power has emerged as an important issue to create fair open access in the electricity markets.

[6] **KeshiReddy ,Saidi Reddy1, Narayana Prasad Padhy, and R. N. Patel [2006]** have analyzed that Congestion in the transmission lines is one of the technical problems that appears particularly in the deregulated environment. There are two types of congestion management methodologies to relieve it.

[7] **Robert J. Kniss [FEB,2006]** The collapse of California's electricity market has caused regulators in other states toreconsider their efforts to deregulate retail electricity markets. Significant progress has been made on the wholesale competition front but major challenges must still be confronted.

[8] **Yixin Ni1, Kenny K.Y. Poon1, Haoming Liu2, Zhou Lan3, Haojun Zhu4, Lin Zhu4** analyzed that Power system restructuring brings about new challenges to power system stability, especially the transient stability (TS) and small-signal stability (SS) of interconnected large-scale power systems under large and cascaded disturbances.

[9] **M. A. Abido A. T. Al-Awami Y. L. Abdel-Magid [July 9-12, 2006]** Have explained, the use of the supplementary controller of a unified power flow controller (UPFC) to damp low frequency oscillations in a weakly connected system is investigated.

[10] **K. H. Kwan, Y. S. Png, Y. C. Chu, and P. L. So[1-3 October 2007]** Have analized a Model Predictive Control (MPC) design for the Unified Power Quality Conditioner (UPQC), an integration of series and shunt active filters to improve power quality in a power distribution system.

[11] **Xu Zhang, Yun Chung Chu, Keck Voon Ling, Xueyou Yang [2009]** Have explained that A Unified Power Quality Conditioner (UPQC) is an integration of series and shunt active filters to improve power quality.

[12] **MeisamHajizadeh ,JavadSadeh, [2011]** Have explained to coordinate and regulate the flexible ac transmission systems (FACTS) and power system stabilizer (PSS) to increase damping in multi-machine power systems.

[13] **Kian Hoong Kwan, KuanTak Tan, Ping Lam So[2012]** Have analyzed that integration of a hybrid system that consist of a proton exchange membrane fuel cell (PEMFC) and an ultra-capacitor (UC) with the UPQC. Apart from performing load sharing with the grid

[14] **Bagepall SreenivasTheja, Anguluri Rajasekhar, Prof D.P. Kothari [December 16-19, 2012]** Have explained an optimal co-ordinated tuned UPFC controller has been proposed to enhance the damping of low frequency oscillations in a single machine infinite bus power system.

[15] **Ahmet Teke, Mehmet EminMeral, Mehmet UğraşCuma1, Mehmet Tümay, Kamil ÇağatayBayindir.[OCT 2012]** Have analyzed that OPEN unified power quality conditioner (UPQC) offers different power quality levels with different electricity bill to their users. OPEN UPQC has more flexible modularity than traditional UPQC for field applications.

[16] M. Soliman [Sept. 2013] have explained that Robustness of Type-l fuzzy logic power system stabilizers (FLPSSs) often lacks mathematical reasoning where the performance of such a stabilizer is often reviewed by transient response of the closed loop system

[17] **Mohamed ElsaidElgamal , Ahmed Lotfy , G.E.M. Ali** Have analyzed that fuzzy logic controlled multi-level inverter based unified power flow controller system is used in a transmission line to maintain

[18] **Urvi Malhotra, *Student Member, IEEE*, and Ramakrishna Gokaraju, *Member, IEEE* (IEEE TRANSACTIONS ON INDUSTRIAL ELECTRONICS, VOL. 61, NO. 5, MAY 2014)** Have explained an add-on self-tuning (ST) control scheme for a Unified Power Flow Controller (UPFC) to assist its conventional PI control system in damping power oscillations.

[19] **Rajabi-Ghahnavieh, *Graduate Student Member, IEEE*, M. Fotuhi-Firuzabad, *Senior Member, IEEE*, M. Shahidehpour, *Fellow, IEEE*, and R. Feuillet, *Senior Member, IEEE*** (IEEE TRANSACTIONS ON POWER DELIVERY, VOL. 25, NO. 4, OCTOBER 2010)Have analyzed various aspects of unified power flow controller (UPFC) control modes and settings and evaluates their impacts on the power system reliability

[20] **ShahrokhShojaeian, JafarSoltani, *Member, IEEE*, and Gholamreza Arab Markadeh** IEEE TRANSACTIONS ON POWER SYSTEMS, VOL. 27, NO. 4, NOVEMBER 2012Have explained that damping of the low frequency oscillations of multi-machine multi-UPFC power systems is investigated based on adaptive input-output feedback linearization control (AIFLC) approach.

[21] **Mahmoud A. Sayed, *Member, IEEE*, and Takaharu Takeshita, *Member, IEEE*** (IEEE TRANSACTIONS ON POWER ELECTRONICS, VOL. 26, NO. 6, JUNE 2011)Have analyzed that Voltage regulation and line loss minimization in distribution networks are challenging problems, particularly when it is not economic to upgrade the entire feeder system.

[22] **M. A. Abido ,A. T. Al-Awami ,Y. L. Abdel-Magid** (IEEE ISIE 2006, July 9-12, 2006, Montreal, Quebec, Canada)Have explained the use of the supplementary controller of a unified power flow controller (UPFC) to damp low frequency oscillations in a weakly connected system is investigated.

CITE AN ARTICLE

Markam, V. P., & Jarariya, S. (2018). STABILITY ENHANCEMENT OF POWER TRANSMISSION USING UPFC WITH FUZZY LOGIC CONTROLLER. *INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY, 7*(8), 424-429.