

# A Review On Power Quality Based On Upfc

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**Abstract-** Power electronic controllers for a flexible ac transmission system (FACTS) can offer a greater control of power flow, secure loading and damping of power system oscillations. A unified power flow controller (UPFC) is a one of FACTS elements that can provide VAR compensation, line impedance control and phase angle shifting. The UPFC consist of two fully controlled inverters, series inverter is connected in series with the transmission line by series transformer, whereas parallel inverter is connected in parallel with the transmission line by parallel transformer. The real and reactive power flow in the transmission line can be controlled by changing the magnitude and phase angle of the injected voltage produced by the series inverter. The basic function of the parallel inverter is to supply the real power demanded by series inverter through the common dc link. The parallel inverter can also generate or absorb controllable reactive power. This paper offers and discusses most papers that used a UPFC to improving the active and reactive power flow of the power systems the unified power flow controller (UPFC) is an advanced member of flexible AC transmission systems (FACTS) group. This paper is focused on three techniques for inclusion of the steady state models of the UPFC in power flow programs. This paper also presents a review of various benefits and applications of UPFC in power flow studies such as minimization of loss, enhancement of load ability, voltage stability etc. using various optimization techniques. A case study is also shown to analysis effect of UPFC using comprehensive NR method based power flow.

**Keyword -** UPFC, Solar. Wind , Grid , Inverter , Dc to Dc Convertor

## I. INTRODUCTION

Power flow calculations are performed in power systems for planning, operational planning, and operation/control. Power flow equations, commonly referred to as power flow are the backbone of power system analysis and design. The power flow problem consists of the calculation of power flows and voltages of a network for a specified terminal or bus conditions. Appropriate steady state model of power system is needed for writing the computer programs. The model includes non-linear algebraic equations, which must be solved iteratively. Power flow calculations are needed for both steady state analysis and initializations of different dynamic analysis.

Flexible AC Transmission systems (FACTS): is a concept based on power-electronic controllers, which enhance the value of transmission networks by increasing the use of their capacity. These controllers are used for enhancing dynamic performance of power systems in terms of voltage/angle stability while improving the power transfer capability and voltage profile in steady state. The Unified Power Flow Controller (UPFC) is, arguably, the most comprehensive device to have emanated so far from the

FACTS initiative. UPFC is capable of providing active and reactive power control, as well as adaptive voltage magnitude control. Power system Security and Transient Stability presented a new UPFC operation algorithm to find the operating point of UPFCs for the system security level Enhancement. [1] The proposed algorithm iteratively minimizes the security index which indicates the overload level of transmission lines. The sensitivity representing the change of the index for a given set of changes in the UPFC real power outputs is derived. In each iteration, with this sensitivity, the proposed algorithm finds a new UPFC operating point that reduces the index or increases the security margin. The algorithm is verified by IEEE 39 bus system with multiple UPFCs. The proposed algorithm is tested with 3 UPFCs on the normal operating system and on the same system with a line fault. The study results show two things.

The first is UPFCs operated by the algorithm can provide the normal operating system with the relief of the power flow congestion in the system and enhance the system security level. And the second is by applying the algorithm the UPFCs with a proper capacity can enlarge the security margin to prevent the overload problem of the system in

an increased load or faulted condition. [2] presented a comparison between three heuristic methods (Simulated Annealing, Tabu Search method, Genetic Algorithms) applied to the optimal location of UPFC in order to enhance the system security. The optimizations are made on three parameters: the location of the UPFC, their types and their sizes. The three methods lead to similar results, but generally Tabu Search method and Genetic Algorithm converge faster than Simulated Annealing. IEEE 118 bus test system is applied for the comparative study. [3] discussed the application of neuro – fuzzy controlled UPFC to improve transient stability of power system. Neuro-fuzzy control method the membership function parameters of fuzzy controller can be computed with learning information about a data set.

This Adaptive Network Fuzzy Inference System (ANFIS) can track the given input-output data the best. The process of training data generation is based on maximizing the energy function of UPFC. Proposed method is tested on a single machine infinite bus system to confirm its performance through simulation. The purpose of maximizing the transient stability margin has been achieved by maximizing the injected energy of UPFC by using its energy function. Consequently, the ANFIS controller operation is based on energy function optimization. By keeping the series (shunt) branch inactive, UPFC can operate as a STATCOM (SSSC) and the corresponding behavior is also evaluated and compared. The superiority of the proposed controlled UPFC over a STATCOM or a SSSC in improving transient stability of a single machine infinite bus has been demonstrated. The functionality of FACTS devices varies, but the UPFC provides the most versatility. To add variety, it can be used in conjunction with a phase angle regulator to perform some of the static synchronous compensator's functions.

This contains the thyristor switched capacitor as well as the thyristor switched compensator (STATCOM). The UPFC's primary duties include injecting voltage and controlling active and reactive power flow. The magnitude and phase angle of the voltage can be varied independently. The power system's transient and small signal stability can be improved by applying actual and reactive power flow regulation to load transmission lines closer to their thermal limits. UPFC is divided into two sections, with UPFCFC being the third. An injector transformer and a voltage source converter are used to make the series branch. To connect to the AC power grid, the UPFC employs a shunt inverter connected in series to the UPFC's output inverter. Voltage and phase angle fluctuations can be injected into the UPFC series branch, and real power can be exchanged with the transmission. A power source is required at its DC terminals for UPFC power supply or absorption in a constant state (apart from the power consumed to compensate for losses).

Solar Photovoltaic: Figure 1 depicts a solar power generation system to go along with this. A solar cell or panel is made up of a series or parallel arrangement of solar cells that are connected in series or parallel to supply the required currents and energy. A solar cell or a solar panel. Solar photovoltaic (PV) systems with integrated inverters are simple to grasp. To begin, solar panels collect sunlight and turn it into useful electrical energy. The DC signals are converted into AC electricity that may be used on the grid after being fed into an inverter (which is what you use in your home). Various switch boxes are provided for added security, and everything is linked and conducted together.

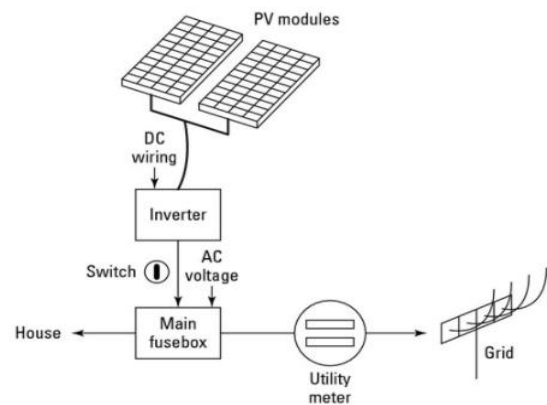


Figure 1 Basic Solar (Photovoltaic) System.

Storage batteries can provide protective power during periods of free sunlight by storing more or part of the power from solar panels. Solar power generation systems are used for private power consumption, weather stations, and radio or television stations, entertainment venues, such as cinemas, hotels, restaurants, villages, and islands. The traditional p-n junction solar cell is the most advanced solar energy collection technology.

The fundamental physics of energy input and carrier output functions the physical properties and the associated electrical properties (i.e., the band distance). The electron needs to have energy greater than the band gap to excite electrons from the valence band to the conduction band. An ideal solar cell has a straight band gap of 1.4 eV to absorb as many photons from the sun's radiation as feasible. The lattice, with its seemingly endless structure, generates bands of permissible energy levels; silicon leaves a band gap (1.1 eV wide) in which no electrons may survive. In contrast, the radius of the sun is close to the temperature of the dark section of the spectrum (approximately 6000 K). This suggests that the bulk of the sun's rays that reach Earth are powered by something other than the silicon group of the sun. Solar cells will use a lot of energy to neutralize these phonons. While this is true, the gap between the phonons and the silicon band will generate heat rather than usable energy (through an overflow called phonons). The highest efficiency for a single meeting cell will be roughly 20%. Current research

methodologies for doing multi-node photovoltaic design to overcome efficiency constraints do not appear to be a cost-effective solution to this problem. An integrated PV device, on the other hand, can be used only during the day and requires direct sunlight (a link to the inside) to function properly.[4]

**Island Mode:** In the event of a mains failure, disconnect the MG from the mains on the PCC by operating a switch that separates the MG from the mains. After disconnection from the mains, the MG will work solely according to a predefined control strategy and supply power to the load by gradually increasing the power provided by all micro-sources. In this way, the load can be turned on, even during a power failure. If the load requirement exceeds the micro-source capacity in island mode, some non-emergency loads can be disconnected. Maintain mains voltage and frequency by operating at least one converter under  $V/f$  control. After troubleshooting, only when the voltage error is less than 3%, the frequency error is less than 0.1 Hz, or the phase angle error is less than 100 can MG be reconnected to the mains [5].

**Benefits of UPFC** In past, researchers have used various techniques in power flow studies to incorporate UPFC to minimize losses, generation costs and maximize loadability, social welfare etc. To seek optimal allocation and parameter settings of UPFC in power system various evolutionary techniques have been applied recently. Genetic Algorithm (GA) and Particle Swarm Optimization (PSO) techniques have been used to find out optimal location and parameter setting of UPFC device to minimize active power losses in a power system. Various such benefits have been surveyed herewith.[6]

## II. LITERATURE SURVEY

The principles of FACTS controller functioning will be discussed in this chapter. This overview would include a cursory glance at the power flow analysis. Finally, we'd provide critiques of comparable works.

**Samiksha 2019:** FACTS is a flexible alternating current transmission system which is used to transfer AC power. FACTS technology is a way of improving power system controllability's and power transfer. There are various FACTS devices used for various purpose. In this paper, we are using UPFC. UPFC is a combination of STATCOM and SSSC. UPFC controls the power flow and regulate the voltage. This paper represents the various modes of operation using series and shunt converters. Unified Power Flow Controller (UPFC) is IGBT based voltage source converter which shows the step change. [6].

**Soham Dey et.al (2020)** this paper proposes a design approach of PID controller based on modern heuristic and intelligent optimization techniques such as GA, PSO, Fruit-fly (FF) and newly introduced Grey Wolf

Optimization (GWO) for a Magnetic Levitation (MAGLEV) System. The parameter tuning of PID controller is accomplished by optimizing a suitable performance index based on ITSE (Integral-time-square error) performance criterion using different optimization techniques. The plant output response is recorded in terms of various time domain specifications and the values are compared to establish the superiority of the proposed GWO. There is much improvement in transient response and steady-state response of the system when GWO technique is used. The controller design process is not only carried out in MATLAB simulation but also implemented in MAGLEV hardware setup for real-time validation.

Numerous maximum power point (MPPT) techniques were implemented and reported in literature to guarantee maximum power harvesting of PV systems, which can be categorized to offline, online and hybrid techniques.<sup>8</sup> In the beginning, simple traditional methods were adopted that considered the linear relationship between voltage and current at the maximum power point with the open circuit voltage and short circuit current as fractional voltage/current techniques.<sup>9</sup> Nevertheless, these offline methods cannot track the maximum power exactly, particularly at fast change in climate circumstances.<sup>10</sup> Then, multiple online algorithms emerged, such as perturbation and observation (P&O) technique,<sup>11</sup> hill-climbing (HC) technique<sup>12</sup> and incremental conductance (InCond) approach.<sup>13</sup> Then, reaching the use of applications of artificial intelligence (AI) such as neural networks (ANN) techniques,<sup>14</sup> fuzzy logic control (FLC) techniques,<sup>15</sup> Fibonacci search technique,<sup>16</sup> particle swarm optimization (PSO) techniques<sup>17</sup> and genetic algorithm (GA) techniques.<sup>18</sup> Several methods for improving, adjusting, and tuning these approaches have been reported in literature.<sup>19-23</sup> These approaches are different in terms of simplicity, speed of performance, efficiency, steady state and dynamic response, count of used sensors and implementation economy[7].

**Bandopadhyay et.al (2020)** there is a new approach of multilevel convertor we can use 24-pulse gate turn-off thyristor based voltage source converter configuration which consist of one 24-pulse GTO convertor as main element. A 24-pulse configuration normally generates a output voltage waveforms which is alternating in nature, contains 23th, 25th,, 47th,49th harmonics which is not desirable. The application of this configuration is reduced voltage harmonics of higher order. In this paper, a new model of 3-level, 24-pulse configuration of rating 33kv, 50MVAR, with advance pulse width modulation technique, PI-controller used to control pulse generator circuit, DC energy stored in a Capacitor bank and two magnetic are designed to exchange the power from STATCOM circuit to transmission system and the same time can optimized the Harmonics of lower order as well as higher order. In this the configuration the DC side

voltage is controlled by implementing a fuzzy PI controller. This compensates transient variation, with varying capacitor side voltage. In this work the fuzzy logic supervision is proposed to minimal THD% from 25% to 2.62 % which remarkable advantage of this configuration[8].

**Durgadevi ;et.al (2019)** Continuously stirred tank reactor (CSTR) plays a major role in the blending of all chemical processing industries. CSTR is found in a wide range of applications that allow liquid, gas and solid reactions in industry, with continuous agitation and a series configuration of concentration and temperature. To obtain a specific concentration, the full concentration of the solution is mixed with the required amount of water. This is usually done using traditional PI and PID controllers. The main objective of the proposed work is to compare and analyze the traditional controller used in CSTR and the soft computing technology that adapts the PI and PID controllers to different error standards. Traditional controllers are difficult to deal with the problems that arise in complex non-linear processes. To solve this problem and improve the dynamic response of the CSTR, a soft computing technique called particle swarm optimization (PSO) is used to analyze the performance of the reactor. The control purpose is to keep the CSTR at the steady-state operating point to reduce the settlement time and reduce the percentage of overrun[9].

**Bo YUAN et.al 2021** : Application of unified power flow controller (UPFC) to power system has become an inevitable trend in the future and related research has achieved certain breakthroughs including theoretical research on calculation of power system after UPFC configuration. However, the fact is not suitable that there is no research overview on calculation and no practical calculation method of power system with UPFC. To this end, this paper summarizes research progress of calculation methods of power system with UPFC from the aspects of power-flow calculation, steady state simulation, transient state simulation, comprehensive calculation, short-circuit current calculation and auxiliary calculation. On this basis, related calculation methods such as steady state calculation, transient state calculation, short circuit calculation and calculation of UPFC adjustment range are discussed which can be used in actual engineering. The work done in this paper aims to provide an overall summary and several practical calculation methods for the research field on calculation of power system with UPFC [10]

**Ramesh Devarapalli et.al (2019)** this paper proposes a new modified version of Harris Hawk's optimization, which improves the stability of the electrical system by adjusting the optimized parameters of the electrical system's vibration damping unit. Harris Eagle Optimization is the latest natural heuristic meta-heuristic optimization technology based on Harris Eagle's hunting

behavior in the wild. The mathematical model of a sample network with a static synchronous compensator (STATCOM) as a power oscillation attenuation unit has been considered for the technology proposed by the research. The performance characteristics of the proposed algorithm for improving the stability of the electrical system are compared with the whale optimization algorithm and the anti-lion optimization algorithm on the considered electrical system model. The eigenvalue analysis and performance characteristics of the system condition during the disturbance are proposed to evaluate the system performance with the proposed method[11].

**Sajid Hussain Qazi et.al (2019)** this paper proposes a study of optimal power controller based on Whales Optimization Algorithm (WOA) for PI controller tuning in an autonomous Microgrid system (MGS). The MGS is based on multiple distributed generation (DG) connected with 120 kV power grid. The proposed controller with four different configurations i.e. controller without optimization, PSO, GWO, and WOA tuned controller will be validated to control and enhance the flow of active and reactive power between MGS and power grid grid-connected mode and during load variation. The simulation results show that MGS is supplying optimal power to utility grid also maintaining sinusoidal voltage and current supply with minimum THD levels. Further, results show that the WOA based controller optimizes the control parameters achieves the 38.46% and 75% better results in terms of active and reactive regulation and sharing, respectively. For modeling of proposed system and applying of optimization techniques, Matlab/Simulink and m/file have been used respectively. The proposed controller performs intelligently while sharing the load power between MGS and utility system[12].

**Vedashree P. et.al 2021** In a Modern power system network, Congestion may occurs due to lack of coordination between demand and supply so as to increase the stress on the existing transmission utilities. The system no longer operates within its thermal limit. Unified power flow controller (UPFC) plays a very important role in the power network to enhance the performance of existing lines as well as to improve the security of the system. UPFC should be located optimally due to high capital investment. In this paper, the allocation of UPFC is obtained by sensitivity based approach in terms of change in active power flow sensitivity index so as to enhance the system performance and The test results has been implemented in the MATLAB with modified IEEE 30 bus network and the performance of the system is validated by Power World Simulator Software 16.0.[13].

**Ting Zhou et.al 2020** At present, the control strategy to prevent the line power from exceeding the limit is adopted in the UPFC demonstration project, and the UPFC system-level control strategy needs to be further studied and improved. In this paper, a method of security and stability

preventive control based on UPFC is proposed. Aiming at the expected fault security and stability problem found in the online security and stability assessment of power dispatching center, based on the calculation of the sensitivity of line overload and bus voltage overrun control, the active / reactive power flow control value of UPFC line series terminal and the reactive power control value of parallel terminal are obtained and executed. This method further expands the application range of UPFC system level function, and an example of an actual power grid verifies the effectiveness of the method.[14].

**Mohammad Ali Daftari et.al (2018)** this paper studies the design of an optimally fractionated PID controller for a time-delayed generator excitation control system. Time delay can cause degradation of system performance and instability. In this research, our goal is to design a fractional-order PID (FOPID) controller for a time-delayed synchronous generator to maintain performance and provide an appropriate delay margin for the system. By defining an appropriate cost function, a particle swarm optimization (PSO) algorithm will be used to design the controller. Finally, by comparing the results of the FOPID controller and the PID controller, the benefits of the fraction order controller are proven[15].

**Mayanka Roy et.al 2019** Power generation and power distribution has to face and monitor many issues such as deterioration of power quality, total harmonic distortion (THD), stability, transient time and many more. For many such problems there is one solution i.e FACTS devices and to increase or enhance its performance it can be utilized along with Artificial Intelligence Techniques. UPFC which is one of the FACT device is been used in this paper, and to take its performance to the extreme limit combination of FUZZY logic controller and UPFC is used, which will drastically gives the difference in previous work and this work, as a result THD value reduces and power system stabilizes. Here basically we proposed Machine Learning Technique which is FUZZY logic and shunt filter with transformer that will work as a controller for controlling power transient conditions and FACT device which is UPFC. [16].

**Narayan Nahak et al. 2019:** In this work a parallel fuzzy PID controller is proposed for enhancing small signal stability of variable solar integrated power system. The controller parameters are tuned by DE-GWO technique. With increase in solar penetration the system oscillations are found to be more aggravated subject to sudden variation in solar output. Time domain simulation has been performed with detail eigen value analysis to justify the effectiveness of controller. The system response predict that proposed controller can damp system oscillations much heavily in contrast to single fuzzy PID controller optimized by DE and GWO techniques.[17].

**Abhipsa Sahu et al. (2018)** represent a load frequency control technology for a two-region, multi-source power system consisting of various power plants based on moth flame optimization technology (MFO). It uses a new controller, which is a two-degree freedom proportional-integral derivative (2-DOF PID) controller. The performance of the proposed controller is checked by multiplying the integrated time of the objective function by the absolute error (ITAE) and then compared with the performance of the integral and the PID controller using different optimization techniques, namely genetic algorithm (GA) and cuckoo search algorithm (CSA)). The analysis shows that the robustness of the proposed system using the 2-DOF PID controller is much better compared to the traditional controller[18].

**Manish Sirvastava et.al 2021** FACTS devices expands the range of options aimed at controlling power delivery along with increasing capacity of current and new lines. The UPFC(unified power flow controller) is a highly complex power electronic interface that could regulate a voltage bus(local) along with optimize power flow in an electric drive system at the same time. By connecting the UPFC at the transmitting and receiving ends, this paper shows how to manage actual as well as reactive(VAR) power flow across the transmission channels. Main aim is to figure out how to monitor and perform a UPFC that will be installed at the transmission line to control complex power flow. Complex power via the transmission line cannot managed if no UPFC is mounted. To test the UPFC's results, simulations are run in the Matlab/Simulink setting. [19].

**Abdelkader Harrouz; et.al 2020** The UPFC is one of the most versatile topologies of the FACTS family. The UPFC can be decomposed in two different power circuits: the parallel one maintains the network bus voltage by consuming or producing reactive power, and the series one controls the active and reactive power flow through the insertion of a series voltage in transmission line. The aim of the present paper is to investigate in details the power quality and the dynamic performance of the control PI for the UPFC in order to improve the stability of the power system hence providing security under increased power flow conditions. The results demonstrate that the control PI is very effective in improving the transient power system stability. [20].

### III. METHODOLOGY

FACTS can improve the controllability and stability of an alternating current system while increasing its power transfer capacity (Flexible Alternating Current Transmission System). FACTS devices produce their own plans and designs by combining basic power framework components (such as transformers, reactors, switches, and capacitors) with power electronics parts. Because thyristor ratings have increased in recent years, power electronics

are now capable of handling loads of tens, hundreds, or even thousands of megawatts. Because FACTS devices are fast, they can help the transmission framework in a variety of ways, such as enhanced transmission ability, improved transient stability, regulation of power flow, reduction of power oscillations, and voltage constancy, for example. FACTS components can enhance transmission capacity by 40–50 percent depending on the device type and rating, voltage level, and network circumstances in a particular location. Similarly to mechanically determined devices, FACTS controllers are less prone to wear and require less maintenance than mechanically determined devices. Costs, complexity, and reliability concerns are now the major barriers to the integration of these promising developments from the perspective of the TSOs.

Promote FACTS penetration will be contingent on innovators' ability to overcome these barriers as a result of increased institutionalization, interoperability, and economies of scale. To increase the performance of the standard PSO formulation, [21] The PSOs in real number space are explained in full, including their gbest and lbest topologies, associated mathematical equations, and an details of the PSO out comes. When some (or all) of the decision variables are integers, an better particle swarm optimizer is projected, along with a detailed description of its theory. Control of UPFC: The UPFC is the most extensively utilized and multipurpose member of FACTS devices, with the ability to govern power flow via power electronics. The UPFC includes a series controller (SSSC) and a shunt controller (STATCOM), which are coupled via a common DC bus (illustrated in Figure 2).

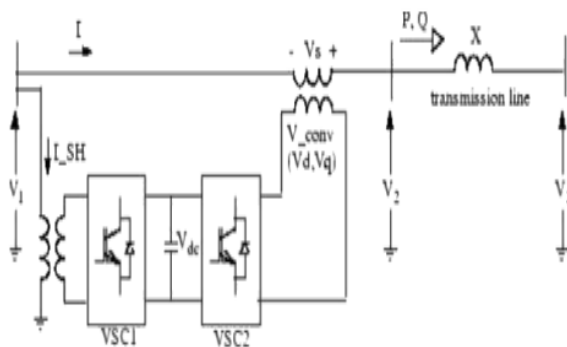


Figure 2 the basic scheme of UPFC.

The Voltage Sourced Converter (VSC) is used in both shunt and series converters, and it is connected to the secondary of the coupled transformer via the coupling transformer. When using VSC, a direct current voltage source is employed to drive the commutated power electronic elements (such as GTOs, IGBTs, and IGCTs) to generate voltage. When the shared capacitor is connected to the VSC's direct current side, it acts as a direct current source (DC).

Shunt converter controls: The shunt converter controls the voltage on transmitting end bus. The series converter provides reactive power at the dc terminals while also committing to active power generation and absorption. In the event of a real power overflow or deficit, boosting or decreasing the dc voltage will be employed to balance it out between the shunt and series converters. By altering the angle and amplitude of the shunt converter-produced voltage, this converter controls both reactive and active power flow [22].

## IV. CONCLUSION

This paper gives the review of UPFC device, its benefits and various optimization techniques used for optimal allocation of UPFC converter for damping oscillations, power loss minimization, enhancement of system load ability, power transfer capability etc. The three steady state models namely UPFC Decoupled model, UPFC injection model and UPFC comprehensive NR model are compared. A case study is also presented to show the effectiveness of UPFC device to regulate voltage magnitude and also controls the power flow between the two busses. It is expected that this review will be helpful to researchers working in the area of power flow and optimal allocation of UPFC.

## REFERENCES

1. M. Albatsh; Shameem Fadi Ahmad; Saad Mekhilef; Hazlie Mokhlis; M. A. Hassan D - Q model of fuzzy based UPFC to control power flow in transmission network 7th IET International Conference on Power Electronics, Machines and Drives (PEMD 2014) Year: 2014 | Conference Paper | Publisher: IET
2. Y Zhang; H F Li; w J Du; Z Chen; H F Wang; S Q Bu Coordinated damping control of phase angle controlled and vector controlled UPFC — A comparative study 12th IET International Conference on AC and DC Power Transmission (ACDC 2016) Year: 2016 | Conference Paper | Publisher: IET
3. Li Peng; Lin Jinjiao; Kong Xiangping; Wang Yuting Application of MMC-UPFC and its performance analysis in Nanjing Western Grid 2016 IEEE PES Asia-Pacific Power and Energy Engineering Conference (APPEEC) Year: 2016 | Conference Paper | Publisher: IEEE
4. Mohammad Ferdosian; Hamdi Abdi; Ali Bazaei Improving the wind energy conversion system dynamics during fault ride through: UPFC versus STATCOM 2015 IEEE International Conference on Industrial Technology (ICIT) Year: 2015 | Conference Paper | Publisher: IEEE
5. L Ramya; J. Pratheeepha A novel control technique of solar farm inverter as PV-UPFC for the enhancement of transient stability in power grid 2016 International Conference on Emerging Trends in Engineering,

- Technology and Science (ICETETS) Year: 2016 | Conference Paper | Publisher: IEEE
6. Samiksha Thakare;M. Janaki;R. Thirumalaivasan Improvement in Power Flow Control and Voltage Regulation using UPFC 2019 Innovations in Power and Advanced Computing Technologies (i-PACT) Year: 2019 | Volume: 1 | Conference Paper | Publisher: IEEE
  7. Soham Dey;Jayati Dey;Subrata Banerjee Optimization Algorithm Based PID Controller Design for a Magnetic Levitation System 2020 IEEE Calcutta Conference (CALCON) Year: 2020
  8. Subhasis Bandopadhyay;A. Bandyopadhyay Harmonics Elimination in 24 Pulse GTO Based STATCOM by Fuzzy Logic Controller with Switching Angle Optimization using Grey Wolf Optimizer 2020 IEEE 5th International Conference on Computing Communication and Automation (ICCCA) Year: 2020
  9. S. Durgadevi;K. Thirupura Sundari;D Raaghavi;R S Akshaya Comparative study of Controller Optimisation for CSTR using Particle Swarm Optimization Technique 2019 Fifth International Conference on Electrical Energy Systems (ICEES) Year: 2019 DOI: 10.1109/ IEEE Chennai, India
  10. Bo YUAN; Peng WU;Hongwei YANG;Jun LU;Yan LI;Shuo WANG;Xiaobo WU;Junkuo LI Research Progress of Calculation and Practical Calculation Methods of Power System with UPFC 2021 6th Asia Conference on Power and Electrical Engineering (ACPEE) Year: 2021 | Conference Paper | Publisher: IEEE
  11. Ramesh Devarapalli;Biplab Bhattacharyya Application of Modified Harris Hawks Optimization in Power System Oscillations Damping Controller Design 2019 8th International Conference on Power Systems (ICPS) Year: 2019
  12. Sajid Hussain Qazi;M.A Uqaili;U Sultana Whales Optimization Algorithm Based Enhanced Power Controller for an Autonomous Microgrid System 2019 8th International Conference on Modern Power Systems (MPS) Year: 2019
  13. Vedashree P. Rajderkar;Vinod.K. Chandrakar Allocation of Unified Power Flow Controller(UPFC) through sensitivity approach for Enhancing the system performance 2021 6th International Conference for Convergence in Technology (I2CT) Year: 2021 | Conference Paper | Publisher: IEEE
  14. Ting Zhou;Xiaotong Xu;Lin Liu;Yanhong Bao An On-Line Preventive Control Method for Security and Stability Based on UPFC 2020 5th International Conference on Power and Renewable Energy (ICPRE) Year: 2020 | Conference Paper | Publisher: IEEE
  15. Mohammad Ali Daftari;Mohammad Ali Nekoui Analysing Stability of Time Delayed Synchronous Generator and Designing Optimal Stabilizer Fractional Order PID Controller using Partical Swarm Optimization Technique 2018 2nd IEEE International Conference on Power Electronics, Intelligent Control and Energy Systems (ICPEICES) Year: 2018
  16. Mayanka Roy;Anil Kumar Kori FUZZY LOGIC based Improvement of UPFC Performance in Power System 2021 6th International Conference on Inventive Computation Technologies (ICICT) Year: 2021 | Conference Paper | Publisher: IEEE
  17. Narayan Nahak;Purba Sengupta;Ranjan Kumar Mallick Improvement of small signal stability of solar integrated power system by UPFC based optimal controller 2019 Innovations in Power and Advanced Computing Technologies (i-PACT) Year: 2019 | Volume: 1 | Conference Paper | Publisher: IEEE
  18. Manish Sirvastava;Sandeep Kumar Verma;Prakhar Singh;Prince Kumar Singh;Amit Agrawal;Vikas Singh Bhadoria Controlling Transmission Line Power Parameters By Using UPFC 2021 Asian Conference on Innovation in Technology (ASIANCON) Year: 2021 | Conference Paper | Publisher: IEEE
  19. Abdelkader Harrouz;Etayeb Boulal;Ahmed Saidi;Ilhami Colak;Korhan Kayisli Reliable Power Flow Control in Parallel Transmission Lines Based on UPFC 2020 9th International Conference on Renewable Energy Research and Application (ICRERA) Year: 2020 | Conference Paper | Publisher: IEEE
  20. J P Zhang;X Wang;W J Du;H F Wang;L L Fan Damping torque comparison and analysis of UPFC based on phase angle control and vector control 12th IET International Conference on AC and DC Power Transmission (ACDC 2016) Year: 2016 | Conference Paper | Publisher: IET
  21. Shilpa S. Shrawane;Manoj Diagavane;Narendra Bawane Concoction of UPFC for optimal reactive power dispatch using hybrid GAPSO approach for power loss minimization 2014 6th IEEE Power India International Conference (PIICON) Year: 2014 | Conference Paper | Publisher: IEEE
  22. Nisha Deshmukh;Amandeep S Bedi;N R Patne Analysis of distance protection performance for line employing UPFC 2016 IEEE 1st International Conference on Power Electronics, Intelligent Control and Energy Systems (ICPEICES) Year: 2016 | Conference Paper | Publisher: IEEE