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Review Article Improvement Of Power Flow And Voltagestability Using Upfc With Artificial Neural Network In Matlab

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Abstract- **The increasing pressure on the power system increases the complexity that is becoming a concern for the stability of the power system and mainly for transitory stability. To operate the system in the event of faults, Flexible AC Transmission System (FACTS) devices that provide opportunities to control the power and damping oscillations are used. This paper presents the enhancement transient stability of the Multi-Machine power system (MMPS) with Unified Power Flow Controller (UPFC) by using Artificial Neural Network (ANN) controller. Performance the power system under event of fault is investigating by utilizes the proposed the strategy to simulate the operational characteristics of power system by the UPFC using Artificial Neural Network (ANN) controller. The simulation results show the behavior of power system with and without UPFC, that the proposed (ANN) technicality has enhanced response the system, that since it gives undershoot and over-shoot previously existence minimized in the transitions, it has a ripple lower. The use (MATLAB R2014a) in all simulations carried out.**

Keywords-**ANN, FACTS; MMPS; UPFC; transient stability.**

I. INTRODUCTION

Power transmission networks have become narrower due to the increased demand for power. A result of many stability problems such as overloading some transmission lines after a disturbance. Therefore, the problem of transitory stability after the main defect is a special transmission-limiting factor [1]. Transient stability refers to the capacity of the power system to preserve synchronization when exposed to severe transient disturbances such as sudden change of load and faults [2]. Include system response resulting from large fluctuations in generator speed and rotor angle. Transient stability of the complex power system can be improved using FACTs devices [3]. The FACTs controllers are able to control network condition very quick. This allows the existing network to obtain used efficiently and thus avoid the need for constructing newlines [4].

The optimal tuning and modelling of various FACTs devices for a dynamic stability enhancement of MMPS studied in [5]. UPFC is the most widely deployed device in FACTs that can provide effective control of power system parameters such by way of transmission voltage, line impendence, and phase angle. Moreover, UPFC can provide either positive or negative power injections positive or interactive. Therefore, it can enhance the operation of the system because it allows for extra efficient control of power flow, super-control system, and stability [6]. The PI controller becomes been used in recent years to improve both temporary and fixed performance, as well as to reject disturbances caused by startup events [7], [8], [9]. Therefore, this paper suggests an Artificial Neural Network (ANN) controller the performance UPFC is improved in event of the fault.

II.OVERVIEW

Reactive power is needed in order to maintain the voltage to deliver active power through power lines. It results from energy storage in the grid due to system inductance and capacitance. Motor loads and other loads require reactive power to convert the flow of electrons into useful work. When there is not enough reactive power, the voltage sags down and it is not possible to push the power demanded by loads through the lines (Kundur, 1994; Co. P. S., 2012) (National Laboratory of Engineering Science and Technology, 2011). Transformers and transmission lines introduce inductance as well as resistance. We must raise the voltage higher to push the power through the inductance of the line.The further the transmission of power, the higher the voltage needs to be raised because of increased line impedance.

III. NEED FOR DISTRIBUTED GENERATION

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The commitments of the competitive electricity markets to go for green energy are helping in motivating the quick development of decentralized or distributed generation (DG). The DGs are emerging as a very highly efficient, reliable source of energy. These DGs connected in distribution systems make these active rather than passive grids, directly affecting the entire power system dynamics, especially the distribution grid. The surplus amount of energy is being fed to the utility grid and when in deficit receives energy from utility having two way communication channel in between.The distribution generation and utility grid can be designed in such a way that it can have enhanced local reliability, reduced feeder losses, support local voltages, increased efficiency.

During the normal mode of operation a utility grid supplies the load and hence operates in the grid connected mode. But in the islanded mode ,or during hurricanes,floods,and other weather related disasters call attention to the vulnerability of the nations electrical grid and the importance of alternatives to ensure continuous electrical power.Weather events,both large and small,cut off power to hundreds of thousands of people and businesses for day exposing the importance of emergency backup power as part of local,state and federal emergency preparedness,response and recovery.Loss of electrical grid power due to storms,natural disasters or high power demands are increasingly common.Diesel powered generators provide the most reliable form of emergency backup power.Many international building codes and standards effectively require diesel generator for code compliance because of the need for rapid response time,load carrying capacity,fuel supply and availability and reliability.

IV.FACTS DEVICES

FACTS devices is an acronym used to describe a wide range of controllers, many of them incorporating large power electronic converters, which may be used to increase the flexibility of power systems and thus make them more controllable. They are defined as alternating current transmission systems incorporating electronic-based and other static controllers to enhance controllability and increase power transfer capability. FACTS devices can regulate the active and reactive power control as well as adapting to voltage magnitude control simultaneously because of their increased versatility and fast real time control.

V.LITERATURE REVIEW

TanushreeKaul, Pawan Rana et. al. 2013 In the recent years ecological concerns and high installation costs have put constraints over construction of new plants and overhead lines in many countries, thereby forcing existing system to be used more efficiently rather than constructing new lines, industry has tended towards the development of technologies or devices that increase transmission network capacity while maintaining or even improving grid stability. Our main objective is to meet the electric load demand reliably while simultaneously satisfying certain quality constraints imposed on the power supply.
Mithilesh Singh, Shubhrata Gupta et.al. 2016 FACTS devices which can change the routes of exchanged powers through the transmission lines by changing angle of bus voltage, amplitude as well as reactance of transmission lines. In this paper technological development with modeling of FACTS devices shown to increase li ne load ability and reduce the transmission congestion by voltage profile improvement. The UPFC is one of the FACTS controllers that can manage the power flow in transmission line by inserting reactive and active voltage component in series with the line. The effectiveness of the FACTS controller mainly depends on their location so main objectives are voltage stability and voltage profile improvement, loss reduction, fuel cost reduction and economical approach for minimize the overall system cost.

Kunal Gupta, Baseem Khan et. Al. 2015 The Flexible ac transmission system is the combination of the power “electronics” devices to controls the power flow and the quantities in power system. The FACTS controllers are used to improve the utilization of the power system and improve its stability. FACTS provide the corrections of transmission functions to fully utilize existing transmission system. It has the capability to increase the transmission capacities to the required level FACTS device can be an alternative to reduce the flows in heavily loaded lines, resulting in increased load ability, low system loss, improved stability of the network, reduced cast of production and fulfiller contractual requirement by controlling the power flows in the network.

Sadjad Galvani, MehrdadTarafdarHaghet. Al. 2014 unified power flow controller (UPFC) operation which can accurately reflect the impact of UPFC on power system steady security. Economic benefit of installing an static synchronous series compensator (SSSC) and adding a new transmission line to power system considering equipment availability and load uncertainty. In addition, application of flexible alternative current transmission systems (FACTS) controllers is obvious and has been considered in various aspects of system operation and planning problems such as system reliability increasing, fuel cost and loss minimization, improvement of system load ability, voltage stability increasing.

The expansion of power generation and transmission has been severely limited due to limited resources and environmental restrictions. Transient stability control plays a significant role in ensuring the stable operation of

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power systems in the event of large disturbances and faults, and is thus a significant area of research. Flexible AC transmission systems (FACTS) controllers have been mainly used for solving various power system steady state control problems. FACTS devices are capable of controlling the active and reactive power flows in a transmission line by controlling its series and shunt parameters[9]. With the growing demand of electricity, it is not possible to erect new lines to face the situation. Flexible AC Transmission System (FACTS) makes use of the thyristor controlled devices and optimally utilizes the existing transmission network. One of such device is Unified Power Flow Controller (UPFC) on which the emphasis is given in this present work. Real, reactive power, and voltage balance of the unified power-flow control (UPFC) system is analyzed. A novel coordination controller is proposed for the UPFC.

The basic control method is such that the shunt converter controls the transmission line reactive power flow and the dc-link voltage. The series converter controls the real power flow in the transmission line and the UPFC bus voltages. Experimental works have been conducted to verify the effectiveness of the UPFC in power flow control in the transmission line[10]. Amicrogrid comprising diesel generator and synchronous generator as the equivalent microsources is done. As in the microgrid there are various distributed generation sources are integrated to each other and to the main grid also, similarly here also the diesel generator and the synchronous generator are modeled as microgrid with IEEE 9 bus system. Integration studies are done and the stability problem is addressed.

Among the several issues related with the microgrid with DGs, stability analysis is of particular interest. Although some of the stability studies of microgrid with DGs have been reported in the literature, here to address the problem of the voltage instability in the system FACTS device is introduced in the system which stabilizes the disturbances in the system when the fault occurs approached by Vikas Sharma [11].

The Unified Power Flow Controller (UPFC) is a original power transmission controller. The UPFC provides a full dynamic controller of transmission parameters voltage, line impedance and phase angle. This paper presents a useful tool for power functions engineers to evaluate the application of the UPFC, its effect on their power system and what would be the shunt and series ratings. This paper provides sets of equations for a system including the UPFC and an equal two bus power system [9]. The development and procedure of interlinked large power systems is becoming difficult. The power transfer proficiency of long transmission lines is usually limited by large signals capability. Economic factors such as the high cost of long lines and income from the delivery of additional power give strong intensive to explore all economically and technically reasonable means of raising the stability limit. The development of effective methods is to use transmission systems at their maximum thermal capability. In this paper a Simulink Model is considered with UPFC model to assess the performance of a single and double transmission line systems (6.6/22) kV. The UPFC model is a member of the FACTS controller with very attractive features and it is a solid state controller which can be used to control real and reactive power flow in a transmission line. In the simulation study, the UPFC model facilitates the real time control and active compensation of AC transmission system. It provides the necessary functional flexibility required for solving the difficulties faced by the utility industry. It should be considered as real and reactive power compensation, capable of individually controlling voltage profile as well as the real and reactive powers in the line. The simulation model is verified for single and double transmission line systems with and without UPFC model in MATLAB / SIMULINK environment [10].

VI.CONSTRUCTION OF UPFC

The UPFC consists of two voltage source converters; series and shunt converter, which are connected to each other with a common dc link. Shunt converter (converter 1)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 inverters, while series converter (converter 2)or Static Synchronous Series Compensator (SSSC) is used to add controlled voltage magnitude line as shown in fig. 1. Each of the branches consists of a transformer and power electronic converter. These two voltage source converters shared a common dc capacitor.

The real power can freely flow in either direction between the ac terminals of the two converters. In this respect, converter 2 provides the main function by injecting an AC voltage Vse, at system frequency with variable magnitude |Vse|, (|Vse| ≤ 0 ≤ |Vse| max) and phase angle ($0 \leq \gamma \leq 2\pi$) in series with the line. On the other hand, converter1 is used primarily to provide the real power demanded by converter2 at the common dc link [4]. The energy storing capacity of this dc capacitor is generally small. The reactive power in the shunt or series converter can be chosen independently, giving greater flexibility to the power flow control.

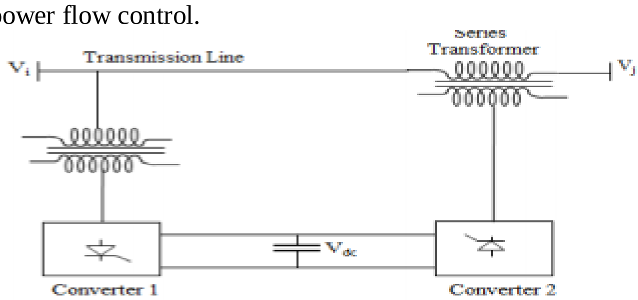

Fig. 1 Configuration of UPF. Artificial Intelligence.

Artificial intelligence refers to the development of systems equipped with the ability and characteristics of a human being. This includes the ability to think, reason out, find meaning, generalize, distinguish, learn from the past experience and to rectify their mistakes. Artificial intelligence has been necessitated by the fact that power system analysis by convectional techniques is becoming increasingly difficult because of the complexity, versatility and large amounts of information that needs to be computed, diagnosed and learnt over a short period of time. Some of the common artificial intelligence techniques include but not limited to fuzzy logic, expert systems, neural networks, genetic algorithm and hybrids of any of the above. Fuzzy systems have an ability to produce exact and accurate solutions from certain or even approximate data. They have superior expressive power, higher generality and an improved capability to model complex but fairly linear problems. Expert systems obtain the knowledge of a human expert in a narrow specified domain into a machine implementable form. The knowledge is stored as rules, decision trees, models and frames. They are unable to learn or adapt to new situations thus not suitable for many power system applications.

Artificial Neural Networks

An Artificial Neural Network (ANN) is an information processing paradigm that is inspired by the way biological nervous systems process information. In the human brain, a typical neuron collects signals from others through a host of fine structures called dendrites. The neuron sends out spikes of electrical activity through a long, thin strand known as an axon, which splits into thousands of branches. At the end of each branch, a structure called a synapse converts the activity from the axon into electrical effects that inhibit or excite activity from the axon into electrical effects that inhibit or excite activity in the connected neurons. When a neuron receives excitatory input that is sufficiently large compared with its inhibitory input, it sends a spike of electrical activity down its axon. Learning occurs by changing the effectiveness of the synapses so that the influence of one neuron on another changes (G.Tulasiram, Simulation of real and reactive power flow control with UPFC connected to a transmission line, 2008) (University L. , 2009) (University L. , 2001) (Siganos, 2009).

VII. CONCLUSION

From the present review work,it was conclude that the use of MATLAB simulation to draw model of utility grid connected by DG with proper control system to be redrawn andagain to be analyzed using FACT devices to improves the power quality of the system.

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