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Improvement of Transient Stability Using Different-Different FACTS Devices

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***Abstract*-Due to increase in population and industrial growth, insufficient energy resources to generate or transmit the power in power system, increase in load causes power demand in the electrical power system. These power demand leads to voltage instability, increase the losses, reduces the power transfer capability and stability of the power system. To overcome this stability problem FACTS devices are optimally located in the power system to examine the stability of the system. To locate the FACTS devices different optimization algorithms are used in order to improve the stability of the electrical power system.**

Keywords-Transient stability, Control strategy, FACTS device, MATLAB/Simulation.

I. INTRODUCTION

The power system becomes unstable due to increase in power transfer it becomes more difficult to operate and becomes insecure because of increase of power losses in the power system. Optimization is a technique which is used to optimally allocate the FACTS devices like Static Var Compensator (SVC) and Inter unified Power Flow Controller (UPFC) in power system to minimize the power losses, improve the Power transfer capability and voltage profile of the system Particle Swarm Optimization (PSO) algorithm [1].

IPFC were located in the transmission line to minimize the transmission line losses by using the Genetic Algorithm (GA) which also controls the power transfer in the power system by series connection of IPFC [2]. Unified Power Flow Controllers (UPFC) was used to improve the voltage stability in the transmission line. GA is an algorithm to optimally locate the UPFC which is used to control the voltage stability and angle of sending and receiving end bus [4]. Optimal allocation of multiple facts device under different overload conditions to improve the power transfer capability and voltage profile of the system by PSO algorithm [5].

SVC and UPFC were optimally allocated under normal, different over load and contingency conditions using PSO technique [6]. UPFC were optimally located in the power system to improve the voltage profile and as well as reduce the losses by Gravitational Search Algorithm (GSA) [7]. Locating the SVC by GA in order to improve the stability of the power system with lower cost [8].

II. LITERATURE REVIEW

Pavlos S. Georgilakis et al. [1] This study presents the latest models and methods of UPFCs in intelligent energy systems and analyzes current and future research trends in this sector and classifies them. Current flow regulation has become increasingly important in the field of intelligent power systems, where it is necessary to increase the percentage of variable renewable energy sources. Unified Power Flow Controller (UPFC) can control the flow of active and reactive power as well as voltage in intelligent power systems in real time, simultaneously or selectively. Various models and methods have been proposed for the control, analysis, and operation and planning of UPFC in intelligent energy systems.

Feng Chen et al. [2] Unified Power Flow Controller (UPFC) is an excellent flexible AC transmission device widely used in the power system. Further UPFC engineering applications are expected to be introduced into the electricity grid in the future, which will barely affect the electricity grid. It is very important to analyze the impact of UPFC on energy saving in the electricity grid. First, the basic properties of the UPFC are briefly presented. Second, the influence of voltage quality, reactive power index and energy savings after the introduction of UPFC into the electricity grid is analyzed in detail using power compensation.

A. C. Zolotas et al. [3] This paper presents the results of a quadratic linear Gaussian linear damping (LQG) schematic to improve the inter-zone mode oscillations of energy systems. A technique is also proposed for ensuring well damped phase / transmission zeros, correctly aligning the tracking equipment for efficient and robust recovery. The performance of the designed system is evaluated in the frequency domain and by appropriate time-domain simulations based on the non-linear model among various scenarios.

Chatterjee D. et al. [4] this article deals with the effect of the simultaneous use of a serial shunt and a FACTS device on the state of transient stability of an electrical system. Thermistor-controlled series compensators (TCSC) and synchronous static compensators (STATCOM) are used as devices. The state of transient stability is evaluated using a trajectory sensitivity analysis (TSA). It has been shown that TSA can be used to determine the optimal positions and operating conditions of both devices to improve transient stability.

JIANG, D et al. [5] this document focuses on TCSC and its role in improving the stability of the power system. The general acceptance of power electronics technologies as a means to improve the performance of the transmission system is demonstrated by EPRI's Flexible AC Transmission Systems (FACTS) initiative, which aims to guide research and development in this direction. One of these electronics is thermistor-controlled series compensation (TCSC).

X. P. Zhang et al. [6] this article presents advanced modeling, analysis and control techniques for flexible AC transmission systems (FACTS). It covers a wide range of network control problems, from closed-loop voltage and current control to voltage and reactive power control, voltage regulation and stability control. Signal using FACTS controllers.

It reflects the recent evolution of power converter configuration, smart grid technologies, developments in the global electricity grid, new approaches to the design of FACTS controls, new controls for distribution control and electronic power controls for the operation and control of wind turbines.

III. CLASSIFICATION OF FACTS DEVICES

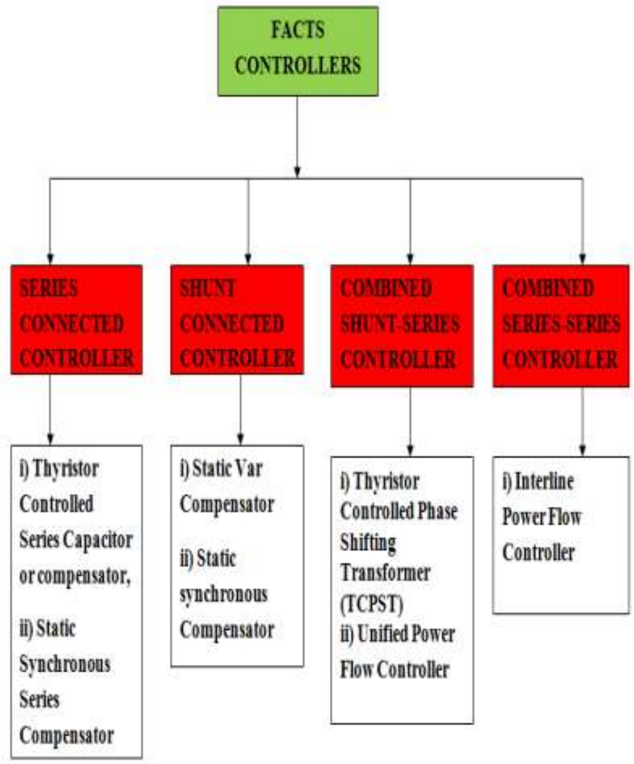

Figure 1: Classification of Facts Device

The Facts controllers can be classified as

1. Shunt connected controllers
2. Series connected controllers
3. Combined series-series controllers
4. Combined shunt-series controllers

IV.ADVANTAGES OF UPFC

Once the limits of the fuel system have been identified and the solution options that can be implemented through system studies identified, the benefits of additional control of the fuel system must be determined. Here is a list of these benefits.

- Better stability of the fuel system
- Better system reliability
- Greater system security
- Increased load and more efficient use of transmission corridors
- Additional flexibility when configuring a new generation

• UPFC can help improve air traffic control by enabling more efficient transactions.

UPFC can help reduce bottlenecks, adjust localization price limits (LMPs) and improve social well-being by redirecting power from overloaded interfaces to under-charged lines.

V.UNIFIED POWER FLOW CONTROLLER (UPFC)

Among the available FACTS devices, 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 basic configuration of a UPFC.

The UPFC is capable of both supplying and absorbing real power 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 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 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.

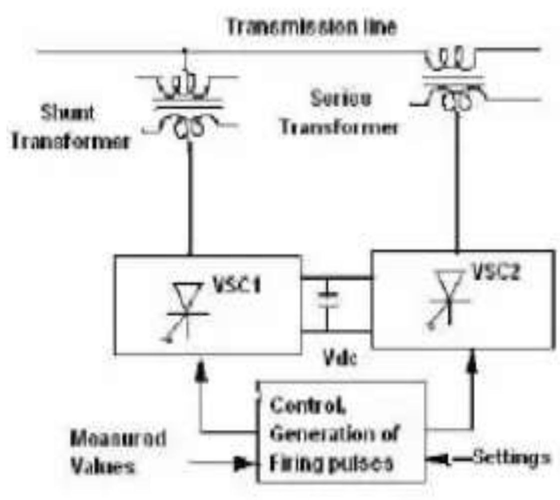

Figure 2 UPFC connected to a transmission line

VI.CONCLUSION

In this paper shows about the different FACTS devices which are used to increase the voltage profile, reduces the line losses, increase the power transfer capability of the system. From this paper we conclude that UPFC has the capability to improve the stability of the system with minimum cost and size.

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