ISSN: 2277-9655
(I2OR), Publication Impact Factor: 3.785

IJESRT

INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY

IMPACT OF NATURE OF LOAD ON FACT DEVICES (UPFC) BY ANALYSING THE POWER FACTOR OF LOAD BUS

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ABSTRACT

In today's era of technology, the power distribution took revolutionary changes. Many researches have been done to improve power quality and many are under process. In spite of some one more factor pull-up that power requirement is continuously increasing which leads a demand of interconnected systems. Due to uncertainty of nature of load the power quality may reduce. In this paper we have modelled a three generator interconnected system which are feeding power to a single variable load. Load can be highly active, highly reactive, partially active, and partially reactive. In this paper we will conclude that how UPFC affects the power factor of the system at variety of load and how much power factor can be compensated by using a best facts device (UPFC) unified power flow controller.

KEYWORDS: upfc, highly active load, Highly Reactive load, interconnected systems, power factor improvement.

INTRODUCTION

As we know that power factor of low transmission distribution line varies from 0.65 to 0.75 and distribution losses are considered high where power factor is low. A high value of current is drawn for a constant load if the power factor if the system is low and as the value of current improves the respective losses which are proportional to square of current also increases. Thus it can be concluded that a power network with low power factor leads to high line losses.

FACTS (Flexible AC Transmission Systems)

A system of all static equipments which are used for energy transmission (Ac electrical energy) is called flexible ac transmission system. These systems are designed to increases power transfer capabilities and enhance controllability of power network in designing of such network power electronic based devices are used.

This power electronic based technology become top rated due to it's wide range availability and it's reliability. The system is used to feed the capacitive and inductive power to the system and its particular requirement as soon as possible and by this way result it improve

Quality of transmission and its efficiency due to use of flexible AC transmission networks came in feasibility with good power factors.

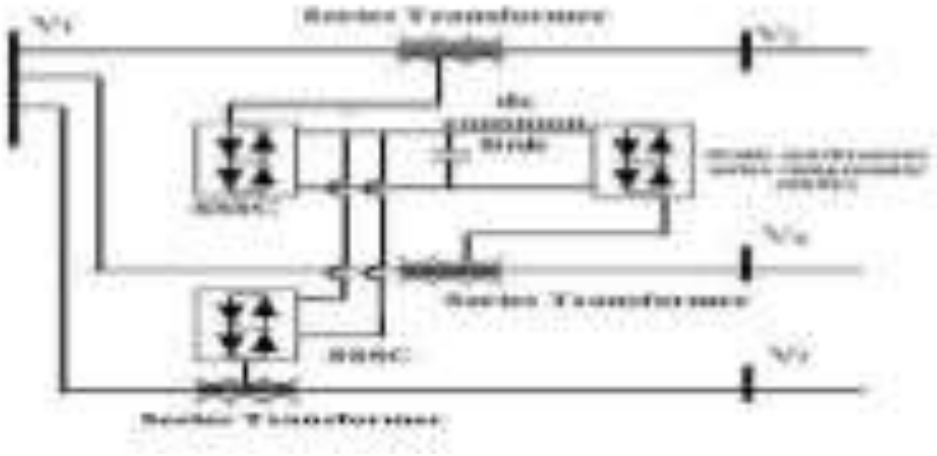
In general FACTS are categorised in a lot of segments. Mainly they are of three type series shunt & hybrid. In this paper we will be dealing with most efficient type of FACTS which belong to hybrid type parent library and named as UPFC (Unified power flow controller).

UPFC (UNIFIED POWER FLOW CONTROL)

In 1995, L gyugyi of Westinghouse has described the concept of unified power flow controller. It is an electrical device used in high voltage transmission network to feed quick active reactive power compensation along with stability in UPFC a series transformer is used to injected current in transmission line and this current is produced by a three phase controller pair. The controller will control flow of reactive and active power.

To provide functional flexibility which cannot be attained by thyristor controlled systems used conventionally some solid state static devices are used in UPFC. As we know that UPFC belong to a hybrid type FACTS which is a

combination of series and shunt type capacitor. In UPFC a series (static synchronous series compensator (SSSC)) and a shunt (static synchronous compensator (STSTCOM)) are placed together and a common DC voltage link is used to couple them. By virtue of same it provides its best function that is to control reactive power in circuit. And UPFC will not work if any fault takes place at source side. By using UPFC phase angle, reactance in Line and voltage are controlled, And it work for only balanced sinusoidal source.



ACTIVE POWER

In a power network if current flows through it's various parts than the power is defined as the rate by which the electrical energy is being consumed or generated. Power transferred in alternating current circuits power transferred through any phase varies with a certain period of time and time is dependent of it's frequency. For periodic reversals of energy flow direction Energy storage elements are used such as inductors and capacitors . The real power (sometimes also known as **Active power (P)**) is the power which results net one direction transfer of energy, averaged over AC waveform's a complete cycle . Some energy is stored in ESD's in circuits, and the stored energy is returned to source, by virtue of same a portion of power flows, and the power is called Reactive Power (Q)

Active power Formulas:

$P = V I$ (In DC circuits)
$P = VI \cos\theta$ (in Single phase AC Circuits)

Reactive power formulas:

$Q = V^2.X$ where X = reactive impedance
$Q = V I \sin\theta$

Power Factor

$$\cos \phi = \frac{P}{(P^2+Q^2)^{1/2}}$$

SIMULATION & RESULTS

As stated above the operation is performed with 3 Generator systems feeding to a variable load as shown in block diagram. The system is modelled with MATLAB(Simulink) v:20013a. The simulation results are carried out with a heavy load of around

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2500Megawatt and converted in four segments: highly active, highly reactive, partially active, and partially reactive.
Simulation Parameters for UPFC:

DC link Voltage:
DC link Capacitance:
Ref. Active Power: 687 MW
Ref Reactive Power: 57 MVar