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An Improvement of Stability Using Robust D-Statcom For Dedication Flicker

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Abstract*—In this paper discuss the different voltage flicker problem that is generate due to voltage up and down. This voltage problem generates flicker, and power quality degradation. The main reason of flicker generation is load change. Mainly caused by the amplitude change, not depended on absolute change. In the last decade there are different research work proposed on this flicker mitigation problem. In this paper discuss the different method to reduces this problem that is shown in this paper. STATCOM and DSTATCOM both are major players to reduce this problem.*

Keywords — ***Power quality, Voltage flicker, STATCOM, D-STATCOM.***

I. Introduction

Energy efficiency primarily concerns how energy producers s well as consumers communicate, thus it either suggested adding between the power system and the relevant demand of electricity. Electricity grid design focuses upon this objective of providing consumers with electrical power. With the dramatic expansion of industrial sectors within that previous half century, energy consumption these have expanded dramatically, necessitating the creation of numerous electricity generating and distribution system facilities. Because as majority of industrial and household power usage rose, the additional strain placed on the energy production grew. Amenities in operation nowadays being connected in addition to creating a complicated infrastructure. Many such causes had made the electrical grid vulnerable to generators. A economic planning system has several aims aside from simply "well-being" as "trust worthy operation" and they include "reduced beginning and running costs" and "a long-term asset." An issue with system reliability is occasionally addressed when an apparatus malfunction is addressed. In many cases, whenever researchers talk about performance of electricity, they mean volts since it is all of the time. electricity performance is highly connected to the overall device dependability for transmission networks. Maintaining electricity supply reliability beyond reasonable standards has been the most challenging task. In the case of bad or high efficiency supply, there are a few drawbacks. Larger power inefficiencies, erratic behaviour of electronic components, or interfering involving better educated are all possible outcomes.

A. Distinctness of Power Quality

An ideal current or voltage signal is one with an uniform magnitude as well as a single controlled dc harmonic waveform. Dc voltage purity depends on the quality of energy obtained as from power either provided to the customer. That deviation of output power, flow, or occurrence from its ideal value, which might cause devices to malfunction, is referred to someone as a system reliability challenge. Electro - magnetic incompatibility is a word that is sometimes used in place with voltage stability; individuals seem to be genetically similar but really not identical. [20]

According to IEEE standards, voltage stability is defined as a process for wiring and energizing sophisticated technology in order to achieve an acceptable and tolerable standard of achievement.

Its total voltage stability is a combination of active and reactive power efficiency. The operating system controls power factor also at connector, whilst the customer's demand controls overall performance at just the junction box. [19]

B. Need of Better Power Quality

There are different power quality issues in power transmission system. Power quality is becoming an important concern because of many reasons. Some major reasons are shown in below figure 1.

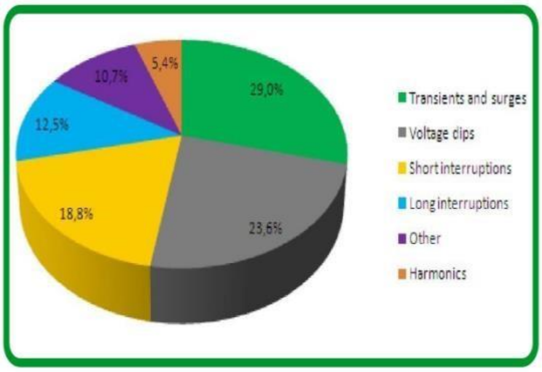

Fig 1. – Power Quality issues

The following are too many large energy traits to consider: Numerous innovative technologies, including such power converters as well as extendable electric motors, are increasingly becoming popular to improve the efficiency of power systems. Such technologies raise the electricity platform's sinusoidal threshold, therefore leads to higher levels of worry.

Voltage regulators and payloads that employ computing system as well as micro - controller management seem to be particularly susceptible to voltage instability.

Electricity grid disruptions have a significant impact on today's greater dependence, since if single failure happens, the whole device is infected.

Overall grid clients' or end users' knowledge of challenges with smart grid and challenges such as under voltage, overheating, blips, and other issues is rapidly growing, resulting in a need for greater energy efficiency.

C. Objective

Power quality must be maintained in order for a power system to operate economically.

As a major power quality concern, voltage sag/swell has been implicated. The following are the project's primary goals:

1.Voltage sag/swell detection in the power system network.

2.To use D.STATCOM to alleviate the power quality issue.

3.Determine the most appropriate control strategy for D.STATCOM.

4.To operate the equipment in order to achieve the desired results.

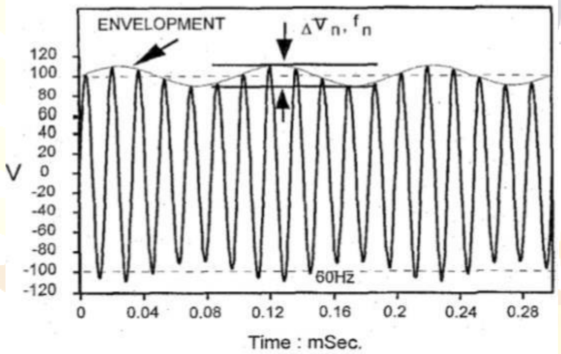

Fig. 2 Voltage Flicker Waveform,

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II. Implementation of Proposed Method

The equipment is a bespoke power solution known as D-STATCOM. Power electronics adds significant value to the power distribution system by bridging the gap between power electronics and power distribution systems. In instances when a power circuit has shorted out, power reconfiguration type bespoke power equipment (where the circuit is reconfigured to restrict current flow rapidly and break the circuit) is applied. To help with voltage flicker, voltage imbalance, and an improvement in power factor, compensating devices are employed.

A. Simulation Model Explanation

A Distribution Static Synchronous Compensator regulates the distribution voltage on a 25kV, 100MVA distribution system. Buses B2 and B3 connect to loads 22 kilometres and 2 kilometres apart, respectively, through two feeders 21 kilometres and 2 kilometres apart. The injectors are required to send power to the loads. For power factor correction, a shunt capacitor is installed between bus B2 and bus B2. A step-down converter rated at 25,000 volts/600 volts is used to connect 600 volts. The energy is absorbed by the continuously changing current load. A DSTATCOM (Directly-heated STATCOM) is connected to bus B3 at a constant frequency of 5 Hz to control the various currents. To put it another way, the apparent power factor varies a lot within a 3MVA range. Throughout the process, the load power factor is kept at 0.9 lagging. The DSTATCOM maintains voltage on bus B3 by either producing or absorbing reactive power. The leakage reactance of the coupling transformer is utilized in order to transmit reactive power. The transformer generates a secondary voltage that is synchronized with the network's main voltage. When the transformer's secondary voltage and the voltage on bus B3 are compared, reactive power flows. In this case, DSTATCOM supplies reactive power and absorbs reactive power (if the secondary voltage is higher than the bus voltage) (if the secondary voltage is less than the bus voltage). The device in figure 3 includes a 25KV/1.25KV coupling transformer that links the and the system. Two arm average bridges, LC damped filters, and serial capacitors connected to the output current are examples of alternate components. Inverter-based dual-inverter circuit designs result in smaller filters and a better dynamic response. First harmonics are seen at 3.36 kHz, while the main operating frequency is 1.4 kHz. This value is 40.

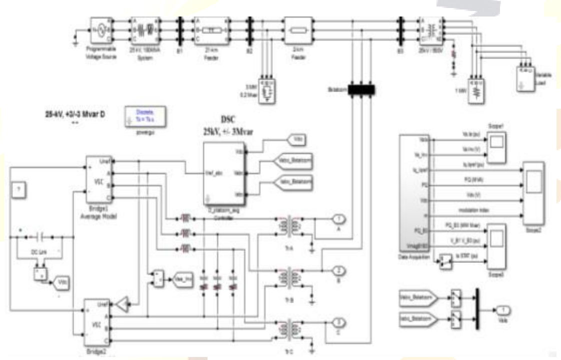

Fig.3 D-STATCOM based power quality enhancement [Complete Model]

B. Components of D-STATCOM

The above D-STATCOM is basically made by these components –

(a). D-STATCOM controller (Voltage Regulator)

Further D- STATCOM controller is the main Universal Bridges

The Universal Bridge block is a universal three-phase power device with up to six controls in a bridge configuration. The power switch as well as device settings may be changed from the panel. When electrical equipment is naturally commutated, the device listing is unique; if forced-commutated, the device listing is different. For a naturally commutated three-phase converter, commutation follows diode and thruster design: part of this proposed work because the flicker and power impairment of proposed work controlled by this component. This component is made by two blocks first one is anti-adlibbing filter and second one is main D - STATCOM controller. D –STATCOM controller shown in below figure 4.

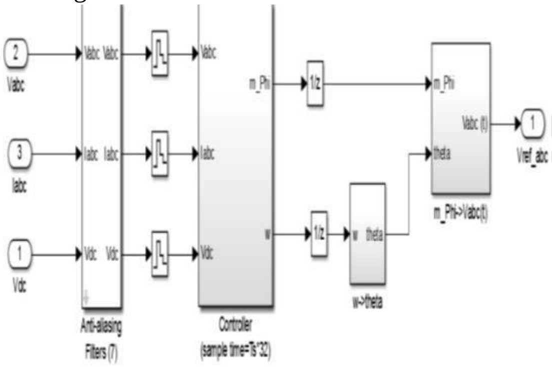

Fig. 4. D-STATCOM Controller

(b).

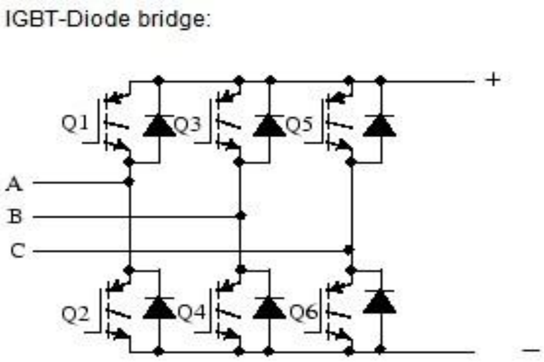

Fig.5.Bridge structure of proposed D-STATCOM

III. Simulation Result

The computation as well as evaluation of the proposed D-STATCOM based power quality improvement are discussed in this part. The input parameters were needed for the calculation of the conclusions. The input parameters for the D- STATCOM based model are shown in table 5.1. The values of Generator (Sending End), Generator (Receiving End), Transformer (Sending End), Transformer (Receiving End), 3 phase mutual Inductance, Pi Network, 3 phase line (Transmission line), Resistance, and Resistor & Inductor are shown in this table (Parallel). These are major values of proposed modal shown in below table 1.

Table 1 Input Parameters of STATCOM based proposed Modal

S. No.	Parameters	Values
1	Source Voltage	25kV/50Hz
2	Source Power	100MVA
3	Total Line length	23Km
4	Coupling Transformer	25kV/1.25kV
5	3 phase mutual Inductance	[R1 (OHMS) L1 (H)][2 2*pi*50] [R0 (OHMS) L0(H)] [4 2*pi*50]/2
6	D – STATCOM (Vdc)	2400 Volt
7	Frequency	50 Hz

Simulate the proposed D-STATCOM and calculates the result for the result calculation we need the result parameters they are – Voltage and reactive power. For the result calculation first inter the flickers in the proposed system. Then analysis the recover output of proposed D-STATCOM circuit and analyze the result at the receiver end measurement bus with the resistive load. Before discussed the outcome of proposed circuit discuss about the voltage and reactive power parameter. There for the next heading is result parameters.

A. ***Result Analysis of D-STATCOM based***

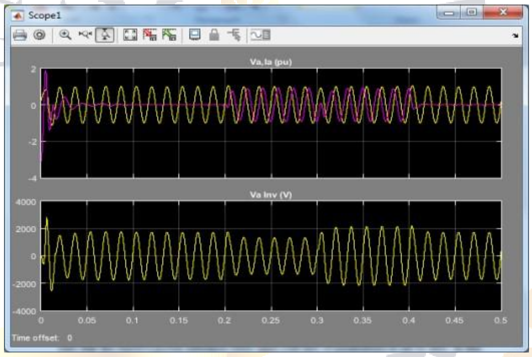

Fig. 6 Phase Voltage and Current Waveform of D –STATCOM

In the above figure 6. shows the phase voltage of D-STATCOM and current waveform of proposed D-STATCOM model. In the above figure clearly see that in between timing of 0.2 and 0.3 second occur voltage flicker repeat this flicker on 0.4 second.

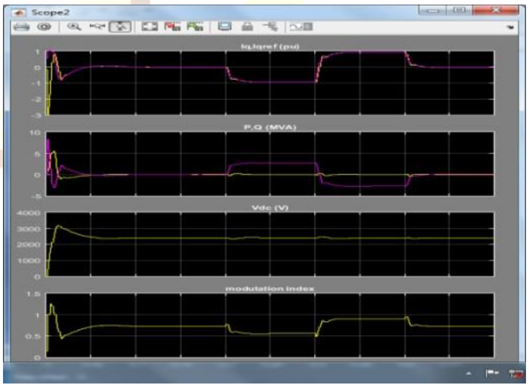

Fig. 7 Dynamic and Steady State response of D-STATCOM

B. *Result Comparisons*

In this part discuss the solution comparison of projected work with previous method on the basis of active and reactive power that is shown in the below figure7.

In the above figure7. shows the active and reactive power of base method that is higher fluctuation and instability as compare proposed method shows lower fluctuation showsn in the next figure that 8.

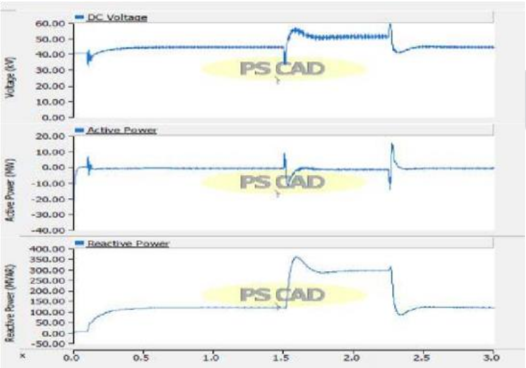

Fig . 8 Base Method's Active and Reactive Power

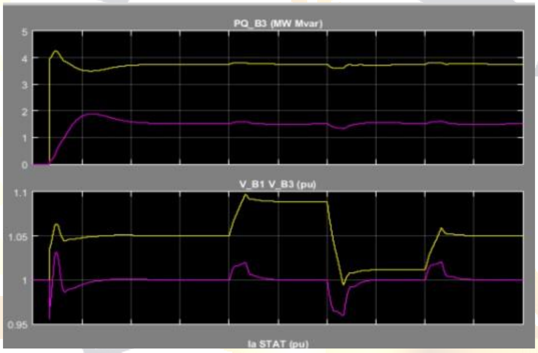

Fig. 9 Active Power of proposed work

IV. Conclusion

In this proposed work by designing a Semolina model in MATLAB, you may simulate a power source with variable load. The proposed research demonstrates how D-STATCOM has been properly applied to a power system to effectively enhance the power performance of the developed system while also managing the flicker problem. The D-STATCOM produces power factor when the system voltage is low. Reactive power is absorbed when the network voltage is high. We have observed in our proposed work that D-STATCOM is comparable than SVC and STATECOM-based devices. In comparing to SVC and STATCOM, the proposed D-STATCOM has reduced harmonics.

Attempt to enhance the proposed DSTATCOM in the future using different soft computing technologies. Principle component analysis (PCA), independent component analysis (ICA), and other machine leaning techniques are some of the optimization methods available for enhancing the proposed work.

Moreover, try to improve the power quality in terms of various parameters such as root mean square error as well as absolute mean error. Trying to provide the auto learning process into the proposed D-STATCOM structure in order to improve the proposed method's performance and reduce THD. There are ways to improve the proposed method's power factor. Also, try to improve the current and voltage. In the future, try to implement the proposed D-STATCOOM on hardware and simplify the proposed work's real-time and run-time output.

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