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Multi Input DC-DC Boost Converter for Hybrid Solar System

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ABSTRACT: This paper deals with congestion Management in high voltage transmission line using thyristor controlled series capacitance (TCSC). The TCSC is a good choice to increase the Transmission Capability of the line. The IEE 8 bus system is modeled using the blocks of simulink and simulated. The results of simulation with and without TCSC are presented. The power that can flow through the line can be controlled by varying the firing angle of TCSC. The simulation results are compared with the theoretical results.

I. INTRODUCTION

In a competitive electricity market, congestion occurs when the transmission network is unable to accommodate all of desired transactions due to a violation of system operation is somewhat more complex in competitive power markets and leads to several disputes. In the present day competitive power market, each utility manages the congestion in the system using its own rules and guidelines utilizing a certain physical or financial mechanism (harry et al., 1998). The limitations of a power transmission network arising from environmental, right – of – way and cost problems are fundamental to both bundled and unbundled power systems. Patterns of generation that result in heavy flows tend to incur greater losses, and to threaten stability and security, ultimately make certain generation patterns economically undesirable. Hence, there is an interest in better utilization of available power systems capacities by installing new devices such as flexible AC transmission systems (FACTS) (Narain and Laszio, 2011). Flexible AC transmission systems devices can be an alternative to increase load ability, low system loss, improved stability of the network, reduced cost of production and fulfilled contractual requirement by controlling the power flows in the network. FACTS devices controls the power flows in the network without generation rescheduling or topological systems seems to be a promising strategy to decrease the transmission congestion and to increase available transfer capability. Using controllable components such as controllable series capacitors line flows can be changed in such a way that thermal limits are not violated, losses minimized, stability margins increased, contractual requirement fulfilled etc, without violating specific power dispatch.

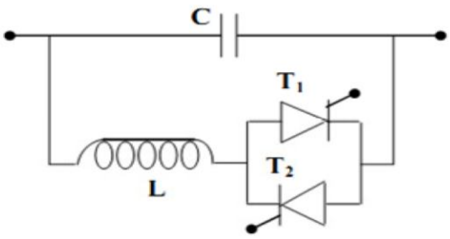

Fig.1. Circuit diagram of thyrister controlled series capacitors TCSC.

The increased interest in these devices is essentially due to two reasons. Firstly, the recent development in high power electronics has made these devices cost effective and secondly, increased loading of power systems, combined with

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deregulation of power industry, motivates the use of dispatching specified power transactions. It is important to ascertain the location for placement of these devices because of their considerable costs.

II. THYRISTER CONTROLLED SERIES CAPACITORS (TCSC)

FACTS devices introduced in the transmission line to enhance its power transfer capability; either in series or in shunt [1]. The series compensation is an economic method of improving power transmission capability of the lines. According to Taher (2008), Thyrister-controlled series capacitors (TCSC) (Figure 1) is a type of series compensator that can provide many benefits for a power system including controlling power flow in the line, damping power oscillations, and mitigating sub-synchronous resonance [2]. The TCSC concept is that it uses an extremely simple main circuit. The Capacitor is inserted directly in series with the transmission line and the thrister – controlled conductor is mounted directly in parallel with the capacitor (Naresh and Mithulananthan, high voltage transformers is required [3] , [16]. This makes TCSC much more economic than some other competing FACTS Technologies. Thus it makes TCSC simple and easy to understand the operation. Series compensation will:

1) Increase power transmission capability.
2) Improve system stability.
3) Reduce system losses.
4) Improve voltage profile of the lines.
5) Optimize power flow between parallel lines.

Figure 2 shows the impedenance characteristics curve of a TCSC device. It is drawn between effective reactance of TCSC and firing angle α (Lehmkoster, 2002) [4], [15].

Net reactance of TCR, X_L (α) is varied from its minimum value X_L to maximum value infinity. Likewise effective reactance of TCSC starts increasing from TCR X_L value to till occurrence of parallel resonance condition $X_L(\alpha) = X_C$, theoretically X_{TCSC} is infinity [5], [14]. This region is inductive region. Further increasing of $X_L(\alpha)$ gives capacitive region, starts decreasing from infinity point to minimum value of capacitive reactance $X_{C.}$ Thus, impedance characteristics of TCSC shows, both capacitive and inductive region are possible through varying firing angle (α) [6] , [13].

$90 < \alpha < \alpha L_{lim}$ Inductive region
$\alpha L_{lim} < \alpha < \alpha C_{lim}$ Capacitive region
$\alpha L_{lim} < \alpha < \alpha C_{lim}$ Resonance region

While selecting inductance, X_L should be sufficiently smaller than that of the capacitor X_C. Since to get both effective inductive and capacitive reactance across the device. Suppose if X_C is smaller than the X_L, than only capacitive region is possible in impedance characteristics. In any shunt network, the effective values of reactance follow the lesser reactance present in the branch [7] , [12]. So only one capacitive reactance region will appears. Also X_L should not be equal to X_C value, or else a resonance develops that result in infinite impedance an unacceptable condition (Xia et al., 2002) [8] – [11].

III. SIMULATION RESULTS

The circuit model of 8 bus system without TCSC is shown in Fig 2.1.The impedance of each line is shown as series combination of R and L. The load at the load bus is represented as series RL load. The Real and Reactive Power at the bus 3 is shown in Fig 2.2. The current and voltage at Bus 3 is shown in Fig 2.3.

The 8 bus system with TCSC is shown in Fig 3.1. A capacitance of 9 μF is used in the TCSC system. TCSC is represented as a sub-system. The circuit of TCSC is shown in Fig 3.2. The Real and Reactive power at bus 7, 1, 3& 11 are shown in Fig 3.3, 3.4 & 3.5 respectively. The current and voltage at Bus 3 is shown in Fig 3.6. The summary of Real and Reactive power is shown in Table 1 for various buses.

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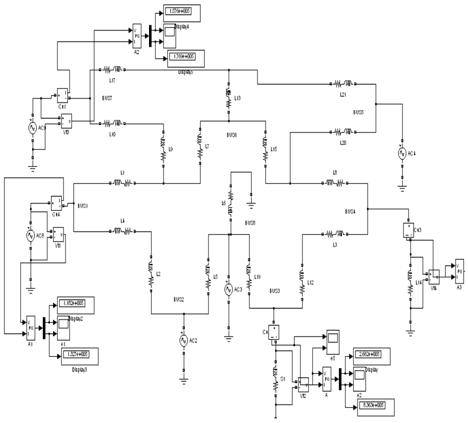

Fig.2.1. 8 bus system

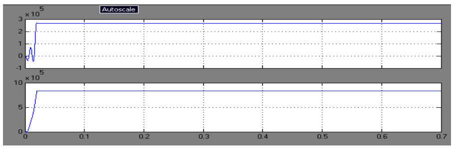

Fig.2.2. Real and reactive power across bus-3

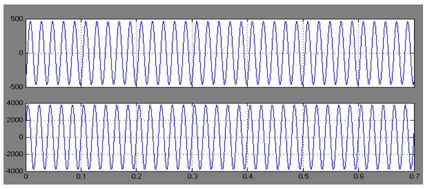

Fig.2.3. Current and volatge across bus-3

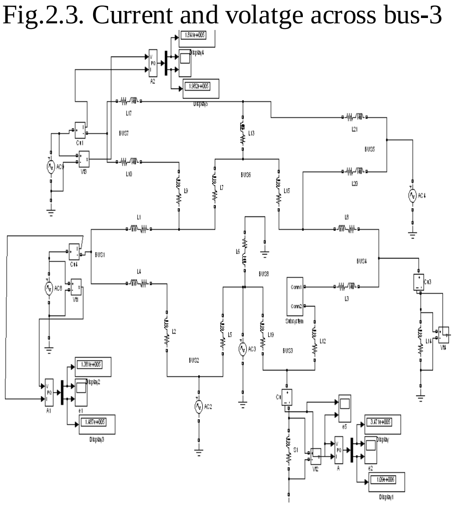

Fig.3.1. 8 bus system with TCSC

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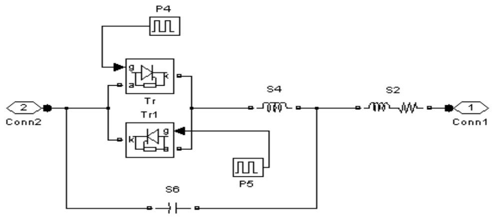

Fig.3.2. TCSC model

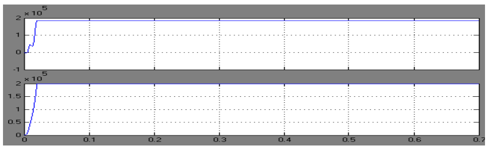

Fig 3.3 Real and reactive power across bus-7

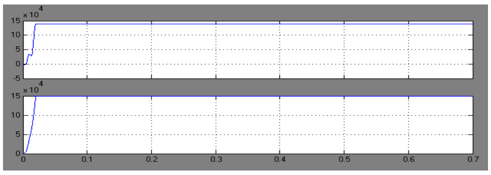

Fig.3.4. Real and reactive power across bus-1

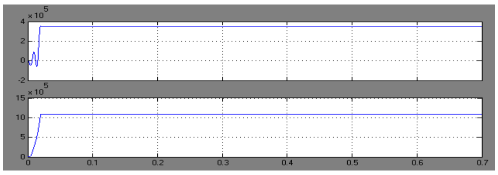

Fig.3..5 Real and reactive power across bus-3

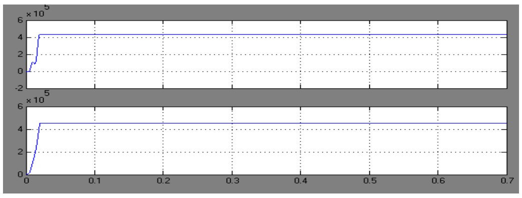

Fig.3.6. Real and reactive power across bus-11

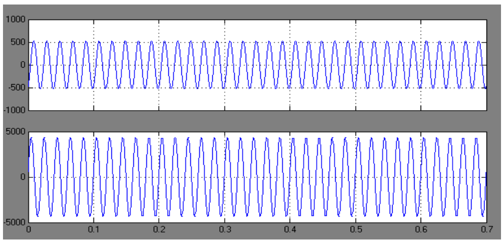

Fig.3.7. Current and volatge across bus-3

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Table 1
Summary Of Results

Bus No	Reactive power (MVA) without TCSC	Reactive power (MVA) with TCSC
BUS-7	0.174	0.198
BUS-1	0.133	0.148
BUS-3	0.836	1.090

IV. CONCLUSION

The 8 bus system without TCSC, with single TCSC and Two TCSCs are modeled and simulated successfully. The summary of the results is also presented. It can be seen that the Real Power capability increases by 13 times by using One TCSC. The simulation results are in line with the predictions.

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