Reactive Power Compensation using Shunt Capacitor Banks

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Abstract— In this paper, Reactive power compensation is done using shunt capacitors at distribution side. The degree of utilization of the power depends on the power factor of the loads connected to the network. Most of the loads in the distribution line, being inductive in nature, consume much of the reactive power. As a result, the power factor of the load deteriorates, leading to the limitation of the active power flow in the line. Consequences of low power factor are higher current, increased losses and voltage dip in the line. This necessitates reactive power control for load compensation. This paper aims at developing simulation model of end user network using compensator as shunt capacitor. This model is carried out in MATLAB/ Simulink. [1].

Key words: Shunt Capacitor Banks, Reactive Power Compensation

I. INTRODUCTION

Recently, the major area of research in power systems is to develop systems that can compensate reactive current dynamically under varying load conditions. Generally load centres are located far away from power generation units, so power transmission and distribution network is built to meet the load demand. The overloaded transmission lines lead to deterioration of voltage profile and decreases the system stability. The degree of utilization of the power depends on the power factor of the loads connected to the network. Most of the loads in the distribution line, being inductive in nature, consume much of the reactive power. As a result, the power factor of the load deteriorates, leading to the limitation of the active power flow in the line. This necessitates reactive power control for load compensation to improve the power factor.

For the improvement of reactive power compensation, shunt connected capacitor banks are most widely used. It maintains power factor as the load demands increase. Here, reactive power compensation using capacitor connected in parallel to the load is discussed as load compensator.[2].

Advantages of shunt capacitors There are some specific advantages of using shunt capacitors such as,

1) It reduces line current of the system.
2) It improves voltage level of the load.
3) It also reduces system Losses.
4) It improves power factor of the source current.
5) It reduces load of the alternator.
6) It reduces capital investment per megawatt of the Load.

Here, in this paper, reactive power compensation is done using shunt capacitor banks and improves power factor.

II. CLOSE LOOP SIMULATION IN MATLAB

The demand of active power is expressing Kilo Watt (kW) or megawatt (mw). This power should be supplied from electrical generating station. All the arrangements in electrical pomes system are done to meet up this basic requirement. Although in alternating power system, reactive power always comes in to picture. This reactive power is expressed in Kilo VAR or Mega VAR. The demand of this reactive power is mainly originated from inductive load connected to the system. These inductive loads are generally electromagnetic circuit of electric motors, electrical transformers, inductance of transmission and distribution networks, induction furnaces, fluorescent lightings etc. This reactive power should be properly compensated otherwise, the ratio of actual power consumed by the load, to the total power i.e. vector sum of active and reactive power, of the system becomes quite less. This ratio is alternatively known as electrical power factor, and fewer ratios indicates poor power factor of the system. If the power factor of the system is poor, the ampere burden of the transmission, distribution network, transformers, alternators and other equipment connected to the system, becomes high for required active power. And hence reactive power compensation becomes so important. This is commonly done by capacitor bank. [2]

- Source voltage = 415 V
- Frequency = 50 Hz
- Base Power = 1000 VA
- Base voltage = 415 V

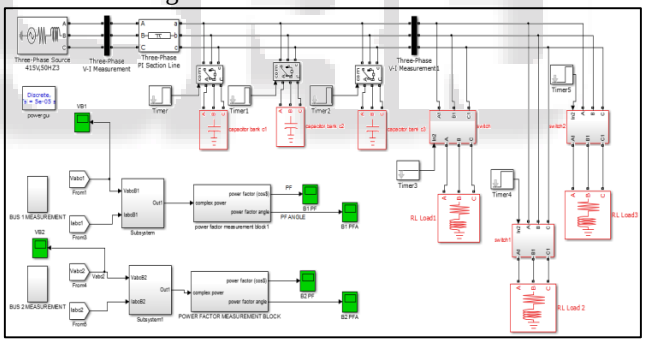

Fig. 1: Matlab close Loop Simlation

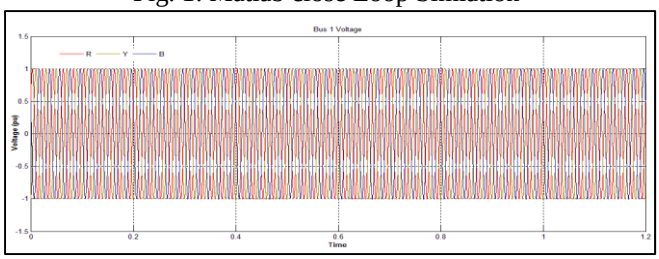

Fig. 2: Bus 1 Voltage Wave Form

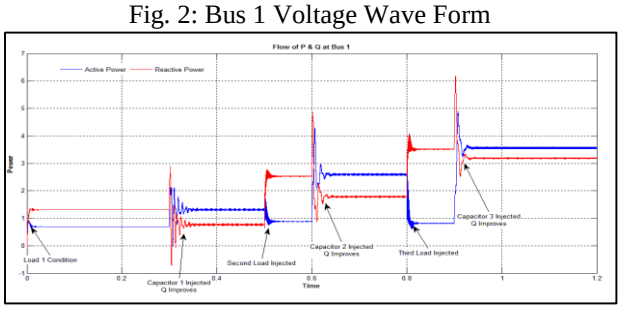

Fig. 3: Flow of active and reactive power at bus 1

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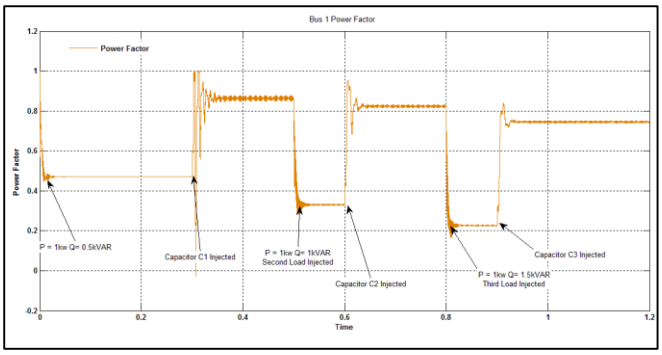

Fig. 4: Power factor at bus 1

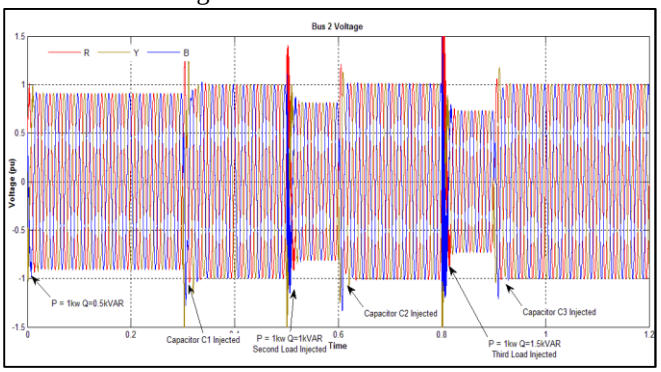

Fig. 5: Voltage at bus 2

III. CONCLUSION

Reactive power compensation at load side in close loop with help of matlab simulation we conclude that close loop simulation voltage at bus 1 almost constant and active power improves and reactive power balanced as the capacitor injects for three different loading condition. We can calculate size of the capacitors as per the load ratings.

At bus 2 voltages are degrade but improves through capacitor banks.

IV. FUTURE WORK

Reactive power compensation will take place with the use of Custom power device i.e. Distributed static synchronous compensator (D-STATCOM). And can overcome the disadvantages of these capacitor banks.

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