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18/ENG04/081

ELECT/ELECT

1. Synchronous motor which is over excited is referred to as a synchronous condenser.  
   Over exciting means giving more current to its field winding(winding which produces the magnetic field).  
   A synchronous condenser acts like a capacitor in terms that it decreases lagging power factor.  
   A synchronous condenser produces reactive power as opposed to consuming in case of ordinary motor. Both transformers and induction motors draw lagging currents from the line. On light loads, the power drawn by induction motor has a large reactive component and the power factor has a low value.  
   The added current flowing to supply reactive power creates additional losses in the power system. Synchronous motors can be used to supply some of the reactive power required by induction motors. This improves the plant power factor and reduces the reactive current required from the grid so in conclusion When a synchronous motor is over excited, it draws *leading current*and behaves like a condenser. Therefore it can be used for power factor correction.
2. This means that the three phase current entering the stator winding has an angle difference (theta) with the voltage, the purpose of using synchronous motor is to use it in leading power factor by controlling the field current in rotor
3. This type of ac motor (synchronous) in effect is used specially to act as a capacitor which function effectively in increasing the p.f. Of the system by injecting leading currents to offset the effect of inductive loads such as caused by the ac-induction motors (asynchronous) that are connected in the electrical circuits or networks whether in lv or hv installations. As the field of the synchronous motor can be altered or adjusted to work effectively in counter-acting the lagging currents of these ac-induction motors, then by the capacitive action of the synchronous motor once running, the power factor is increased to higher value thus improving the overall system p.f. Of a particular electrical network.
4. A synchronous motor has better power factor as compared to that of an equivalent induction motor. This is mainly because

* Synchronous motor has no slip
* Stator supply is not required to produce magnetic field
* Mechanical load on the rotor remains constant
* Synchronous motor has large airgap

1. An adaptive control method is presented for controlling and maintaining the power factor of synchronous motors close to unity in the presence of load disturbances.
2. A synchronous motor running on no-load with leading power factor-will act as synchronous condenser. The same motor when operated with lagging power factor on no-load will draw a reactive current from the system depending upon the system voltage.
3. Like an induction machine, an under excited synchronous machine too will consume reactive power; a properly excited synchronous machine neither consumes nor produces reactive power; An over excited synchronous machine can produce reactive power.
4. Efficiency is higher than of an induction motor of the same output and voltage rating because there are neither losses related to slip nor the additional losses due to magnetizing current. With synchronous motors, there is no difference of speed between air gap rotating magnetic field and rotor.
5. Power factor of induction motor depend on load and speed. Power factor of synchronous motors might be fixed. Usually such motors r huge and therefore their reactive power causes huge losses. The power factor of a lagging load on the secondary side increases.
6. When ever a synchronous machine(either motor or generator) is being operated at leading power factor(PF), it always shed out its leading Reactive VARs( volta-ampere reactives) for such machine which is defficient with leading VARs( operating at lagging PF) and thus the VARs defficient machine will absorb that leading VARs supplied and tend to improve its lagging PF to unity.

Now, when this machine is done with improvement of its PF from lagging to unity and still being fed with Leading VARs in excess, it will eventually start acting like a source of Leading VARs for some other Leading VARs defficient machines connected in the power system.

Synchronous condensers( phase modifiers) are the best examples for this kind of practises. Phase modifier is nothing but an un loaded synchronous motor operated at leading PF and without load.

By this practise, the power factor is improved and the overall performance of the entire power system gets improved.

Further, to answer this question, since the question is about the synchronous motor, always remember that any kind of **motor** (either synchronous or induction or DC)require active power to do the mechanical work. Now, if it is being perated at leading PF(only in case of AC motors, as described above) it will supply the reactive power (+Q) and if it is operating at lagging PF, it will absorb the reactive power(-Q), where symbols have their usual meanings .

1. the maximum efficiency of these kinds of motors is generally quite high, like 85% to 90%, but that depends a lot on the having the right mechanical load attached, meaning a load that uses a major amount of the available mechanical power output of the motor.
2. Unlike induction motor,synchronous machines run on synchronous speed. Not only that, but these machines are able to maintain constant speed throughout the operation irrespective of load. As speed is synchronous, there is no difference of speed between air gap mmf and rotor which makes it efficient over an induction motor whose speed varies as per load condition and slip.
3. synchronous machines have separate DC excitation which reduces machine's excitation dependency on main supply, hence better PF. Whereas IM have no such provisions, hence low PF.
4. power factor is a number which in very small length tells us about the efficiency of an AC machine like induction motor. As we know, in an inductive load current lags the voltage by a certain angle. Higher the lag, lesser will be the power factor. In case of DC current, voltage and current are inphase but in case of AC, at a given instant the current lags the voltage. As a result, the actual or active power to the machine is product of Voltage and cosine component of current. cosine of the angle between Voltage and Current is called power factor. If this factor is low, the line current will have to increase to transfer required power. This increase in current will cause Voltage drop and unnecessary heat loss thus decreasing efficiency.
5. An over-excited synchronous motor has a leading power factor. This makes it useful for power factor correction of industrial loads. Both transformers and induction motors draw lagging (magnetizing) currents from the line. This improves the plant power factor and reduces the reactive current required from the grid.