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**ELECTRICAL MACHINES II ASSIGNMENT**

1. A harmonic is a voltage or current at a multiple of the fundamental frequency of the system, produced by the action of non-linear loads such as rectifiers, discharge lighting, or saturated magnetic devices. Harmonics in electrical machines results in increased heating in the equipment and conductors, misfiring in variables speed drivers, and torque pulsation in motors. Harmonics is generated by non-linear loads.

In synchronous motors, since the harmonics are at higher frequencies, they produce higher core losses in the motor than the power frequency would. This results in increased heating of the motor core, which (if excessive) can shorten the life of the motor.

In synchronous generators, the effects of harmonic may include; efficiency losses, overheat and derating (reduction of power rating). As a result of the high impedance of synchronous generators, current harmonic distortion is easily transferred to voltage harmonic distortion and therefore affecting other loads supplied from that source.

1. Stator windings of large generator are star connected to achieve lesser stress on insulation and copper saving. In this case voltage per phase is less for a given line voltage which reduces insulation requirement and this also reduces the number of turns, hence copper is also saved.

Since phase voltage=1/$√3$ Line voltage

And generated emf in phase winding, Ef=$√2πfN∅$

 Where N=number of turns

1. The armature for large machines is stationary to avoid electrical losses associated with slip rings and brushes.
2. Brushless generators undergo less maintenance because there are no brushes to replace or fix and they have fewer internal parts that can be damaged.