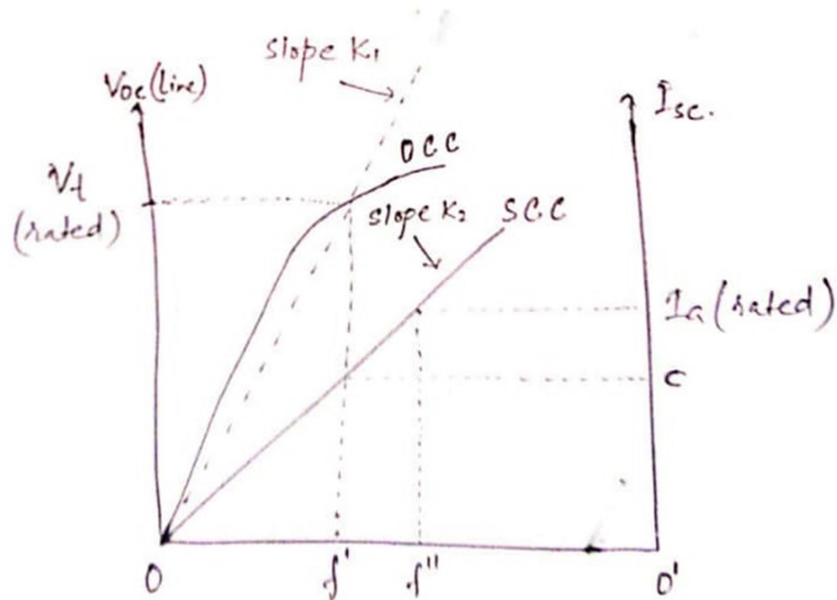


Short circuit Ratio (SCR)

It is defined as the ratio of the field current required to produce rated voltage on open-circuit to the field current required to produce rated armature current with armature terminal shorted while the machine runs at synchronous speed.



#Determination of SCR

$$SCR = \frac{O_f'}{O_f''}$$

as per definition.

$$X_s(\text{adjusted}) = \frac{V_t(\text{rated})/\sqrt{3}}{O_c}$$

$$K_1 = \frac{\text{OC voltage}}{\text{field current}} = \frac{V_t(\text{rated})}{O_f'}$$

$$K_2 = \frac{\text{SC current}}{\text{field current}} = \frac{I_a(\text{rated})}{O_f''} = \frac{O_c}{O_f'}$$

Now,

$$\Rightarrow SCR = \frac{O_f'}{O_f''} = \frac{V_t(\text{rated})}{K_1} \cdot \frac{K_2}{I_a(\text{rated})}$$

$$\Rightarrow SCR = \frac{O_c}{V_t(\text{rated})} \cdot \frac{V_t(\text{rated})}{I_a(\text{rated})}$$

$$\Rightarrow SCR = \frac{O_c}{V_t(\text{rated})/\sqrt{3}} \cdot \frac{V_t(\text{rated})/\sqrt{3}}{I_a(\text{rated})}$$

$$SCR = \frac{1}{X_s(\text{adjusted})} \cdot X_{\text{Base}}$$

$$SCR = \frac{1}{X_s(\text{adjusted}) \text{ p.u}}$$

Significance of S.C.R.

→ Synchronous generator has large variation in terminal voltage with a change in load for generator with low value of S.C.R. i.e. To keep the terminal voltage constant field current is to be varied over wide range

→ Synchronizing power is small for lower S.C.R. machine.



Low stability limit

or,

less stable when operating in parallel with other generators.

→ Under short circuit condition armature current is small for low S.C.R. generator

→ Size and cost of the machine are also affected by S.C.R.

$$E_f \propto \phi \quad (\text{field flux per pole})$$
$$E_f \propto \frac{\text{field mmf per pole}}{\text{reluctance of air gap}}$$

also,

$$L \propto \frac{1}{\text{reluctance of air gap}}$$

$SCR \propto \text{air gap reluctance}$
or
 $\propto \text{air gap length.}$

It is evident from above that SCR may be increased by increasing the length of air gap. With the increased air gap length, the field mmf is to be increased for the same E_f . In order to increase the field mmf either field current I_f or no. of field turns is to be increased. This requires greater height of field poles.

↓

Overall diameter of
the machine increases

Type of machines	SCR
Cylindrical rotor machines	0.5 - 0.9
Salient-pole machines.	1.0 - 1.5
Synchronous compensator	0.4