Lecture 18

Friday, 22 March 2024 3:31 PM

EE114 - Power Engineering 1

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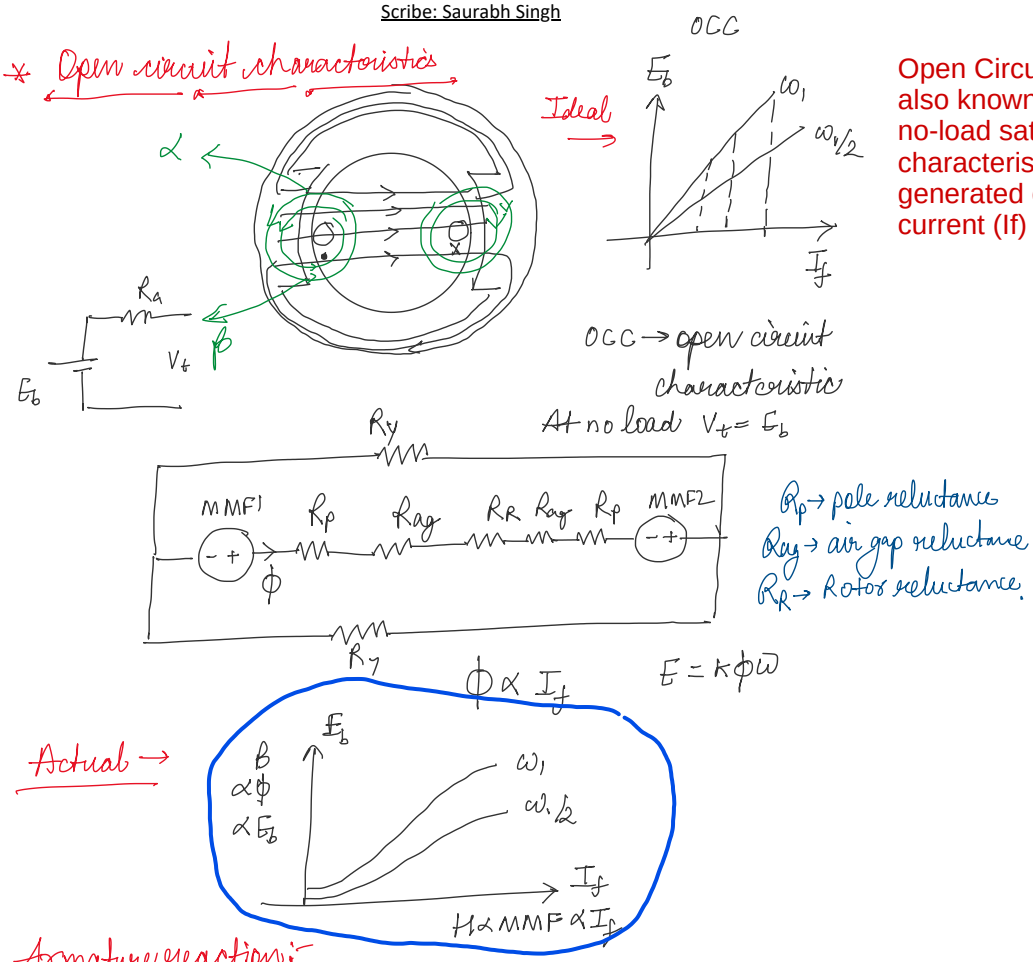
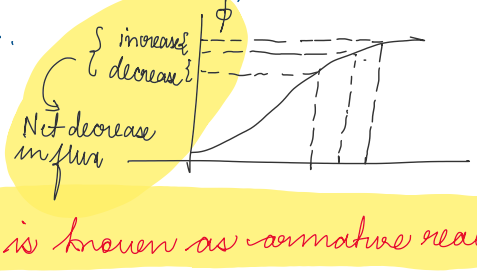
Open Circuit Characteristic (OCC) (E0 / If) is also known as magnetic characteristic or no-load saturation characteristic. This characteristic shows the relation between generated emf at no load (E0) and the field current (If) at a given fixed speed.



Armature reaction:

Does the current flowing in the armature change the flux per pole ?

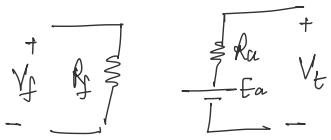
1. Due to reluctance due to air gap, the flux produced by the armature winding will circle through the pole (shown in green). Cancelling the flux while going in and aiding while going out.
2. If it was a non-saturable core the net effect of the armature flux would have been zero.
3. In a saturable core, there is a net decrease in flux.



This is known as armature reaction.

To account for armature reaction

$I_{f(net)} = I_f - I_{fAR}$



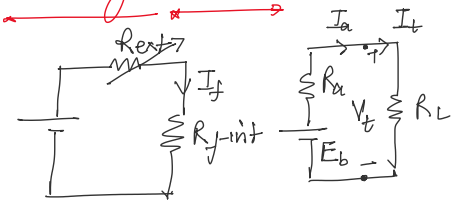
Shunt excited motor → If V_t & V_f are connected to the battery/source in parallel

Seperately excited motor → If V_t & V_f are connected to seperate DC sources

Series excited motor → If the field winding & armature windings are connected in series

Compound motor → Both series & shunt field windings are present.

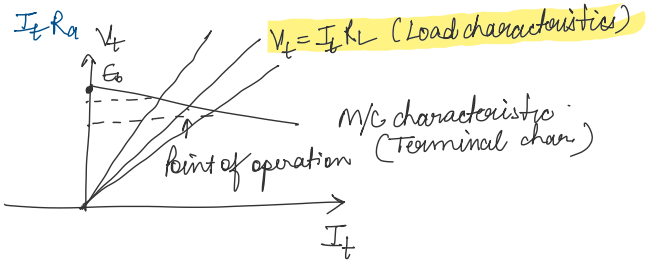
* Seperately excited generator :-



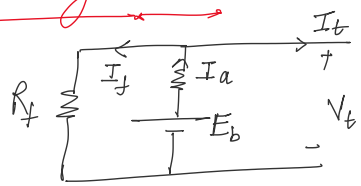
$I_a = I_t$

$R_f = R_{ext} + R_{f\_int}$

$V_t = E_b - I_t R_a$



* Shunt excited generator :-



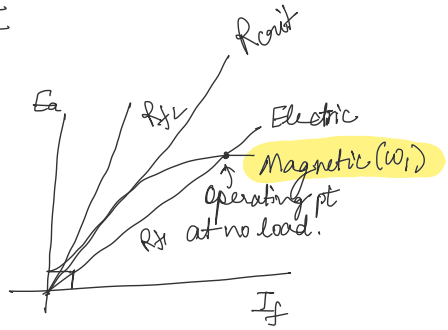
No load condition

$I_t = 0$

$I_a = I_f$

$E_a = (R_f + R_a) I_f$

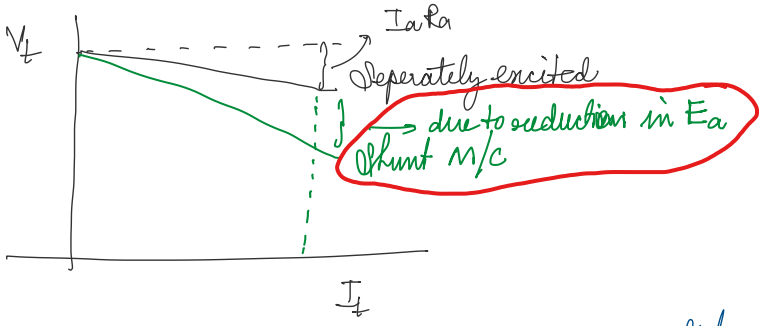
$E_a \approx R_f I_f$



Initially field current is zero. Due to residual flux there will be some E_b as motor rotates. E_b will produce I_f. I_f will increase ϕ, E_b will increase in turn increasing I_f again. This happens until stable operating point is reached.

At R_{f2}, there will not be enough voltage produced by the generator.
We would want the R_f to be less than $R_{critical}$ to have appreciable voltage generated.

If the field winding is connected such that the field produced by it opposes the residual field, then the machine will not work.



Short circuit current in seperately excited gen is very high
In case of shunt generator, the short circuit is very less as I_f will be zero as terminals are shorted -