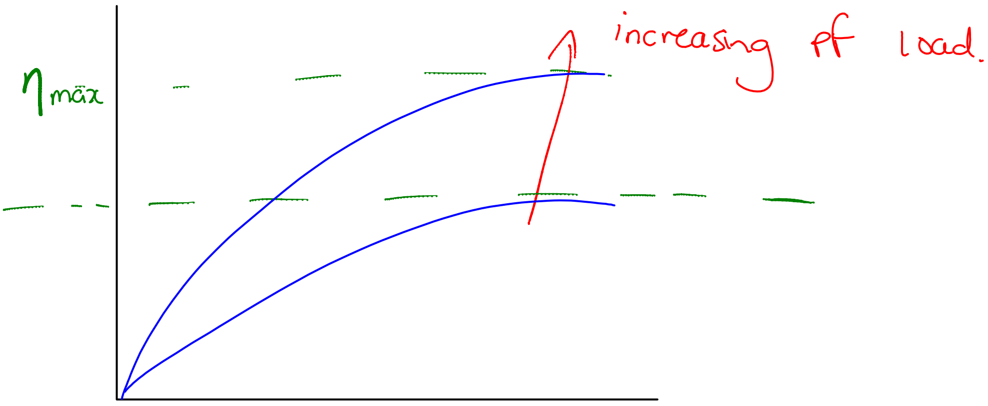
Lecture 8

Tuesday, 1 September 2009
4:38 PM

$$\eta = \frac{\text{output}}{\text{input}}$$

$$\vdots$$

$$= \frac{V_2' I_2' \cos\phi_2}{V_2' I_2' \cos\phi_2 + P_c + (I_2')^2 R_T}$$



$$\frac{1}{\eta} = \frac{V_2' I_2' \cos\phi_2 + P_c + (I_2')^2 R_T}{V_2' I_2' \cos\phi_2}$$

$$= 1 + \frac{P_c}{V_2' I_2' \cos\phi_2} + \frac{(I_2') R_T}{V_2 \cos\phi_2}$$

$$\frac{d\left(\frac{1}{\eta}\right)}{dI_2'} = \frac{P_c}{V_2' \cos\phi_2} -1 (I_2')^{-2} + \frac{R_T}{V_2' \cos\phi_2}$$

$$= \frac{1}{V_2' \cos\phi_2}\left[-\frac{P_c}{I_2^2} + R_T \right]$$

$= 0$

$$\therefore -\frac{P_c}{I_2'^2} + R_T = 0$$

$$\Rightarrow P_C = I_2'^2 R_T$$

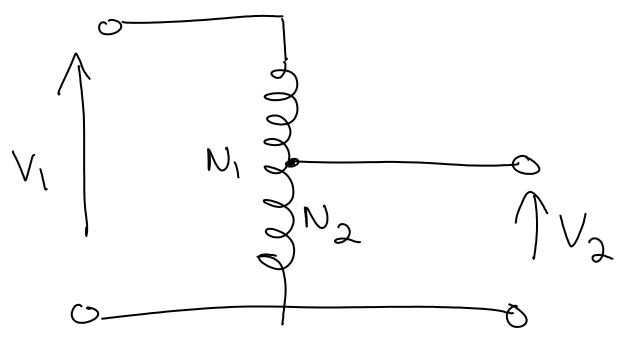
ie core losses = winding losses.

Transformer Voltage Regulation

$$\text{Voltage Regulation} = \frac{V_2(n.l) - V_2(load)}{V_2(load)}$$

as a %

Auto-Transformer



$$\frac{V_1}{V_2} = \frac{N_1}{N_2}$$

$$\frac{I_1}{I_2} = \frac{N_2}{N_1}$$

Advantages

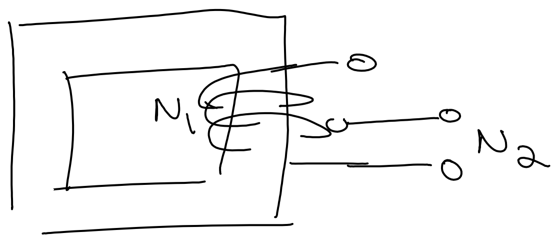
1. less copper required to construct the auto t-f.

2. using a slider over exposed turns can give continuously variable turns ratio. (variac)

Disadvantage

No galvanic isolation between 1° and 2° windings.

windings.



$$V = \sim \frac{d\phi}{dt}$$

The auto t/f may be used to step-up or step-down the voltage and parameters may be obtained by using the normal tests.

Variacs

- special form of auto t/f.
- N_2 is continuously variable

$\therefore V_2 = \left(\frac{N_2}{N_1}\right) V_1$ is also continuously variable.