In case of transformers, the frequency $f$ remains constant so that

$P_h = K_h B_m{}^n f \propto B_m{}^2$ (take $n \approx 2$) and,

$P_e = K_e B_m{}^2 f^2 \propto B_m{}^2$

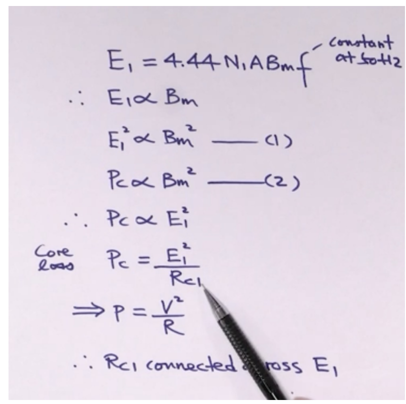
Thus, $P_c = (P_e + P_h) \propto B_m{}^2$

Let $\varphi = \Phi_m \sin \omega t$, then

$$v = e = N\frac{d\Phi}{dt} = N\Phi_m \omega \cos \omega t$$
$$= N(B_m A)(2\pi f)\cos \omega t$$
$$= 2\pi NA(B_m f)\cos \omega t$$

Therefore, the root mean square (rms) value of the voltage is given by

$$V = V_m / \sqrt{2} = 2\pi NA(B_m f)/\sqrt{2} = 4.44 NAB_m f$$




A 23-kVA, 2300/230-V, 60-Hz transformer has the following parameters:

$R_1 = 4\ \Omega$, $R_2 = 0.04\ \Omega$, $X_1 = 12\ \Omega$, $X_2 = 0.12\ \Omega$,

$R_{c1} = 20\ \text{k}\Omega$, and $X_{m1} = 15\ \text{k}\Omega$

Draw the actual equivalent circuit of the transformer. If the transformer delivers 75% of its rated load at 0.866 pf (lag) at rated voltage, determine

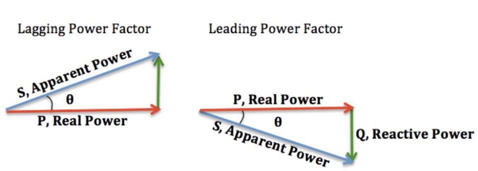
a) the input current,

b) the input voltage,

c) the total copper loss,

d) the core loss, and

e) the input power. (Solutio




The terms ‘leading’ and ‘lagging’ refer to where the load current phasor lies in relation to the supply voltage phasor. Capacitative-> leading; inductive-> lagging