ex. Take transformer equivalent circuit from previous example and express on a per-unit basis.

Ratings: 220 : 440 V_{rms}, 25 KVA @ 60 Hz → $a = 1/2$

Choose $S_{base} = 25\ KVA$

$V_{base} = 440\ V_{rms}$ ← secondary side

$$I_{base} = \frac{S_{base}}{V_{base}} = \frac{25 \times 10^3}{440} = 56.\overline{81}\ A_{rms}$$

$$Z_{base} = \frac{V_{base}}{I_{base}} = \frac{440}{56.\overline{81}} = 7.744\ \Omega$$

or

$$= \frac{V_{base}^2}{S_{base}} = \frac{440^2}{25 \times 10^3} = 7.744\ \Omega$$

Per-Unit (Secondary) Equiv. Circuit values:

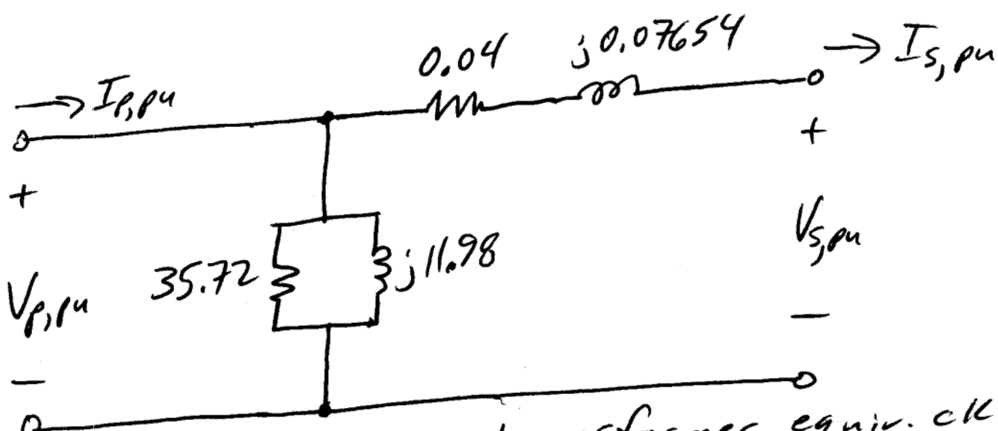
$$R_{c,s_{pu}} = \frac{R_{c,s}}{Z_{base}} = \frac{276.6}{7.744} = 35.72 = 35.7$$

$$X_{m,s_{pu}} = \frac{X_{m,s}}{Z_{base}} = \frac{92.8}{7.744} = 11.98$$

$$R_{eq,s_{pu}} = \frac{R_{eq,s}}{Z_{base}} = \frac{0.3097}{7.744} = 0.0400$$

$$X_{eq,s_{pu}} = \frac{X_{eq,s}}{Z_{base}} = \frac{0.5927}{7.744} = 0.07654$$

ex. cont.



per-unit transformer equiv. ckt.

What if I wanted the primary side per-unit Equiv. circuit?

$S_{base} = 25\ \text{KVA}$ (no change)

$V_{base,p} = V_{base,s}\, a = 440(1/2) = 220\ V_{rms}$

$I_{base,p} = \frac{S_{base}}{V_{base,p}} = \frac{25\times 10^3}{220} = 113.\overline{63}\ A_{rms}$

$Z_{base,p} = \frac{V_{base,p}}{I_{base,p}} = \frac{220}{113.\overline{63}} = 1.936\ \Omega$

Express primary equiv. circuit values on per-unit basis.

$R_{c,p_{pu}} = \frac{R_c}{Z_{base,p}} = \frac{69.1}{1.936} = 35.69 \simeq 35.7$

$X_{m,p_{pu}} = \frac{X_{m,p}}{Z_{base,p}} = \frac{23.2}{1.936} = 11.98$

$R_{eq,p_{pu}} = \frac{0.0774}{1.936} = 0.4 \quad + \quad X_{eq,p_{pu}} = 0.07654$

look familiar?

Same equiv. ckt!