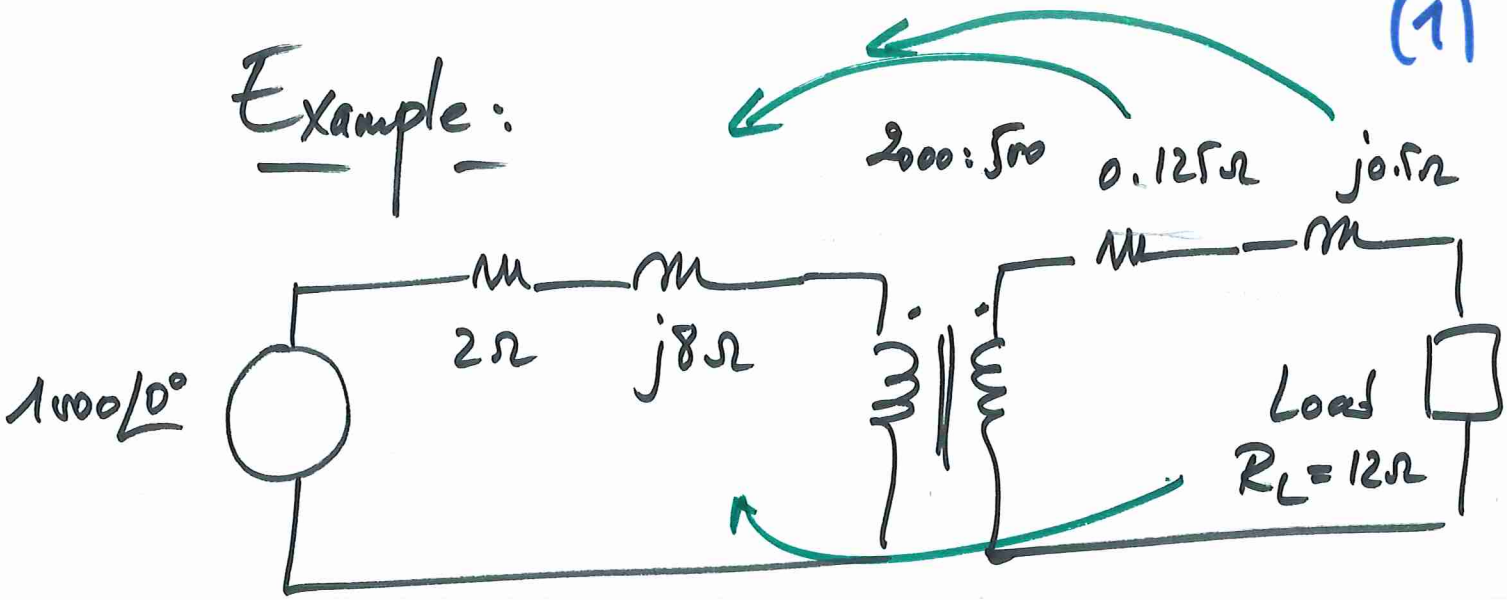
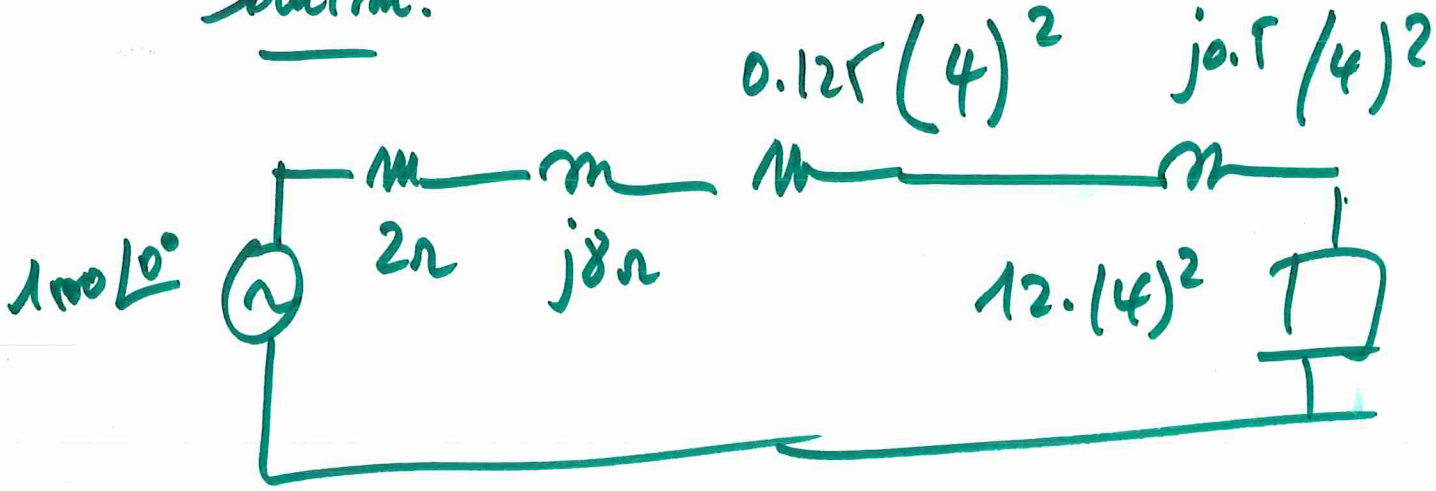
Example:

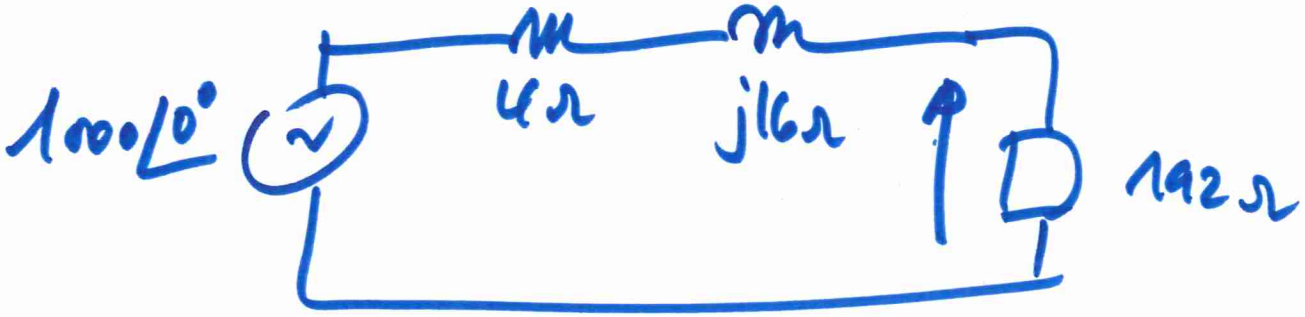


1/ Find V_{load}.

2/ Find the voltage regulation

Solution:





$$\bar{I} = \frac{1100\angle 0^\circ}{(4+j16+192)} = 5.08\angle -4.67^\circ \text{ A}$$

$$\bar{V}_{load} = (192\Omega)\bar{I} = 975.36\text{V} \angle -4.67^\circ \text{ V}$$

$$\bar{V}_{load\,(LV)} = \frac{975.36\text{V}}{4} = 243.8 \angle -4.67^\circ$$

$$VR = \frac{|V_{NL}| - |V_{FL}|}{|V_{FL}|} \cdot 100$$

($|V_{FL}| \rightarrow 243.8$)

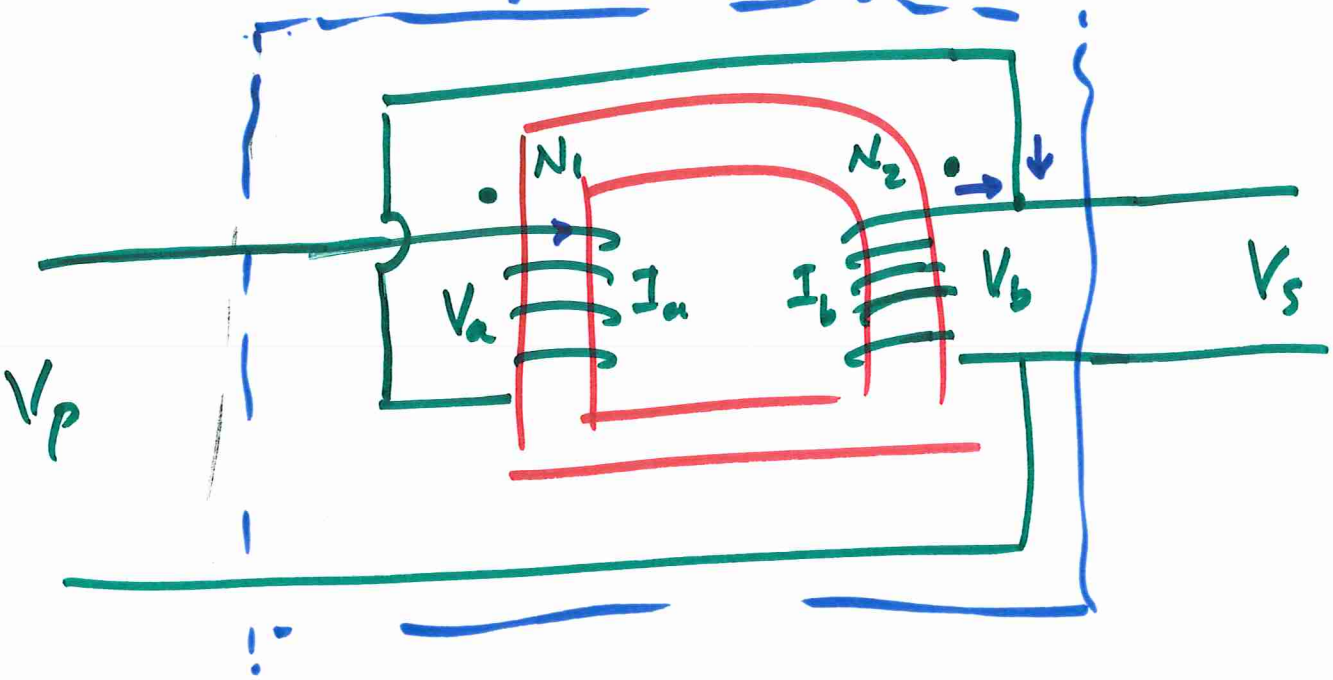
V_{NL}? $|V_{NL}| = 250$.

$$VR = 100\left(\frac{250 - 243.8}{243.8}\right) = 2.54\%.$$

$$\eta = \frac{P_{out}}{P_{in}} \rightsquigarrow \text{Real power.}$$

$$= \frac{P_{in} - P_{loss}}{P_{in}} \rightsquigarrow \text{related to } R|I|^2.$$

Autotransformer:



$$\frac{V_a}{V_b} = \frac{N_1}{N_2}, \quad \frac{I_a}{I_b} = \frac{N_2}{N_1}.$$

$$\bar{V}_p = \bar{V}_a + \bar{V}_b, \quad I_p = I_a.$$

$$V_s = V_b, \quad \bar{I}_s = \bar{I}_a + \bar{I}_b$$

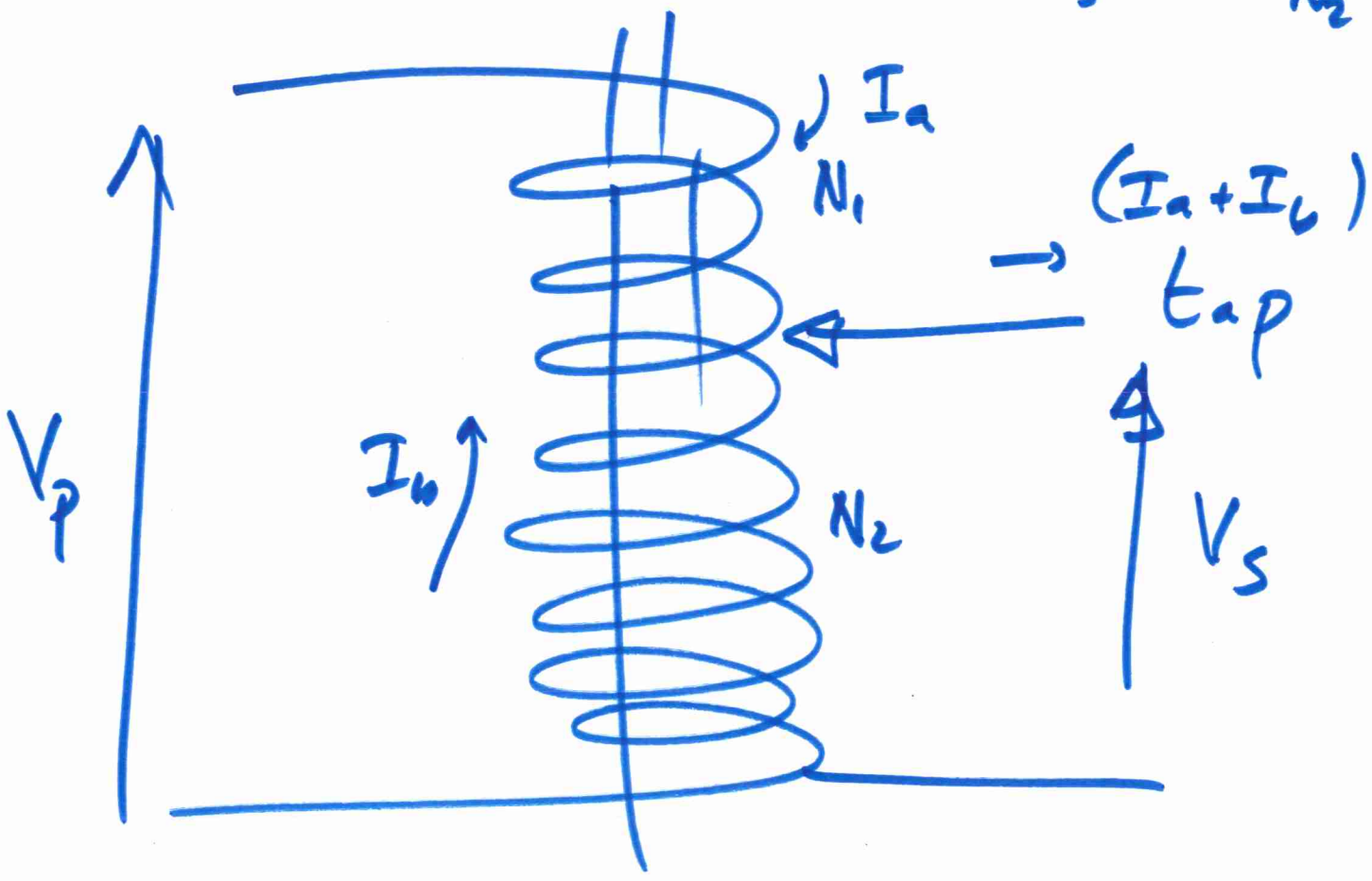
$$\frac{V_p}{V_s} = \frac{V_a + V_b}{V_b} = \frac{V_b\left(\frac{N_1}{N_2}\right) + V_b}{V_b} = \frac{N_1 + N_2}{N_2}.$$

$$\frac{I_p}{I_s} = \frac{I_a}{I_a + I_b} = \frac{I_a}{I_a + \left(\frac{N_1}{N_2}\right) I_a} = \frac{1}{\frac{N_2 + N_1}{N_2}}.$$

$$\frac{I_p}{I_s} = \frac{N_2}{N_1 + N_2}.$$

$$\boxed{S_p = S_s}$$

$$\frac{V_p}{V_s} = \frac{N_1 + N_2}{N_2}.$$



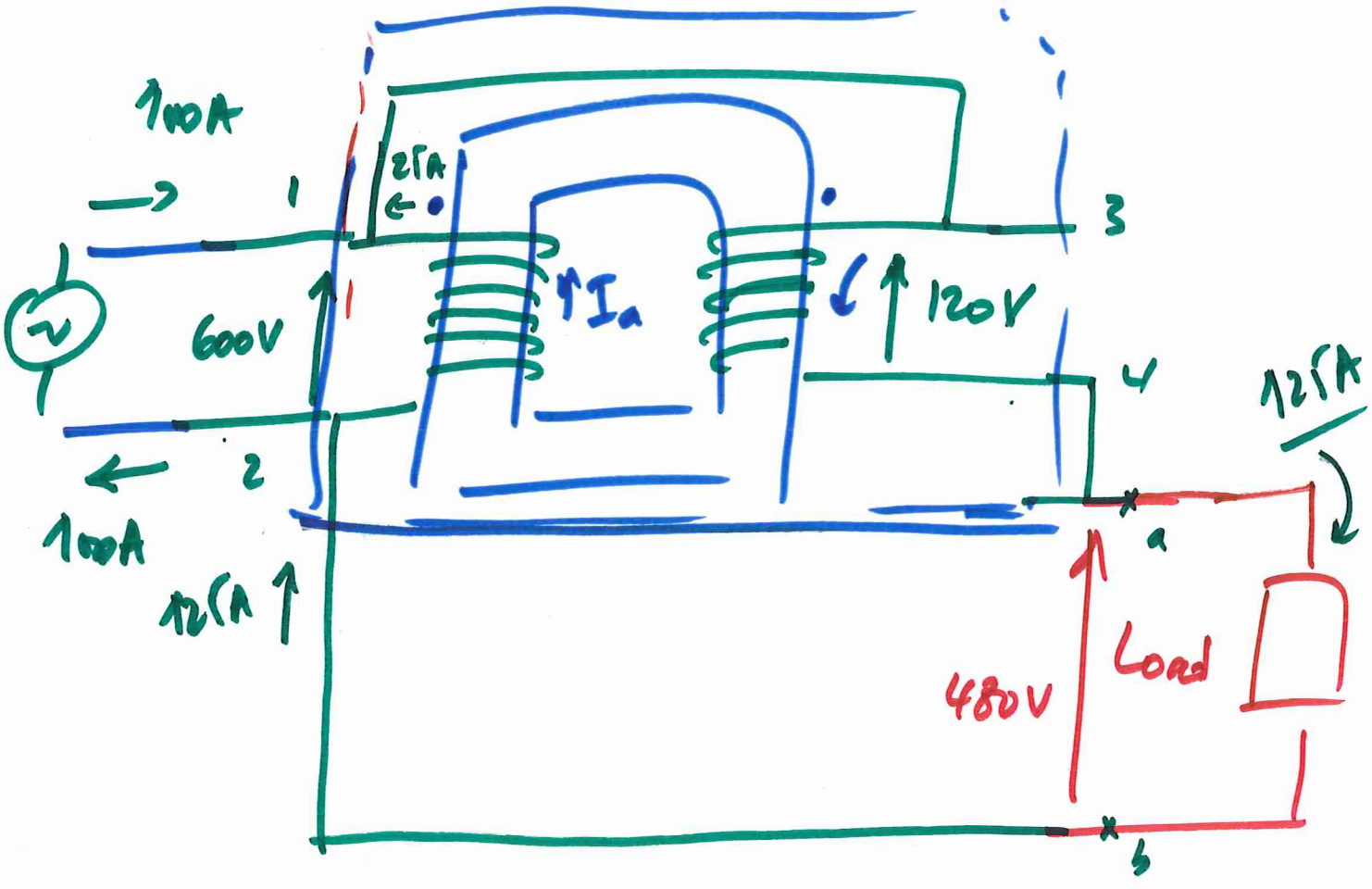
Example:

A regular transformer 15kVA.

600V : 120V , 60Hz.

(1) Connect as 600V : 480V autotransformer

(2) Find V, I, S at each side.



$$I_a = \frac{15\,kVA}{600V} = \underline{25A}.$$

$$I_b = \frac{15\,kVA}{120V} = \underline{125A}.$$

$$S_p = 600V \cdot 100A = \underline{60\,kVA}.$$

$$S_s = (480V)(125A) = \underline{60\,kVA}$$