

## Transformers

1. An ordinary transformer, when connected as an autotransformer, has an advantage of being able to deliver more power to a load than when connected conventionally. Explain how this is true using numbers from your homework.

An autotransformer connection, in the homework, delivered 90kW using a 15kVA transformer. This is possible because there is a current path around the transformer, but voltage and current are fixed by the transformer's parameters.

2. A certain single phase transformer is rated at 10kVA, 4160V: 480V. Its magnetizing inductance is 13.2 Henries and the core loss resistance is 45k ohms, both referred to the high voltage side. Find the capacitance value placed on the low voltage side that will make the transformer resonate at 55 Hertz.

Restate the given

$$L_{\text{high}} := 13.2 \cdot \text{H} \quad f_r := 55 \cdot \text{Hz}$$

Find the turns ratio to get reflection to the low voltage side.

$$a := \frac{4160 \cdot \text{V}}{480 \cdot \text{V}} \quad a = 8.667$$

Reflect inductance to the low voltage side.

$$L_{\text{low}} := \frac{L_{\text{high}}}{a^2} \quad L_{\text{low}} = 0.176 \text{ H}$$

$$\text{Because } \frac{1}{\sqrt{L \cdot C}} = 2 \cdot \pi \cdot f_r \quad \text{Then } C_{\text{low}} := \frac{1}{\left[ (2 \cdot \pi \cdot f_r)^2 \cdot L_{\text{low}} \right]} \quad C_{\text{low}} = 47.648 \mu\text{F}$$

3. A short circuit test is conducted on a 200kVA, 13,200V:240V single phase transformer. The voltage is measured at 800V and the power is measured at 250W. Standard procedures described in the text were used. Find the equivalent series resistance.

$$V_{sc} := 800 \cdot V \quad I_{sc} := \frac{200 \cdot \text{kV} \cdot A}{13200 \cdot V} \quad I_{sc} = 15.152 \text{ A} \quad P_{sc} := 250 \cdot W$$

Use the procedures in the text to find the series impedance. The resistance can be found from the power

$$Z_{SE} := \frac{V_{sc}}{I_{sc}} \quad Z_{SE} = 52.8 \Omega$$

$$R_{SE} := \frac{P_{sc}}{I_{sc}^2} \quad R_{SE} = 1.089 \Omega$$

