

(1)

A transformer is made up of a 1150-turn primary coil and an open-circuited 80-turn secondary coil wound around a closed core of cross-sectional area 56 cm^2 . The core material can be considered to saturate when the **rms** applied flux density reaches 1.45 T. What maximum 60-Hz **rms** primary voltage is possible without reaching this saturation level? What is the corresponding secondary voltage? How are these values modified if the applied frequency is lowered to 50 Hz?

(Pay attention to the flux is a rms value)

(2)

Why does the short-circuit test essentially show only i^2R losses and not excitation losses in a transformer?

Why does the open-circuit test essentially show only excitation losses and not i^2R losses?

Homework 3

(1) ① 60 Hz

$$\dot{U} = j 4.44 f N \dot{\Phi}_m$$

$$\dot{U}_1 = j 4.44 f N_1 \dot{\Phi}_m$$

$$= j 4.44 f N_1 \dot{B}_m A$$

$$= j 4.44 \times 60 \times 1150 \times \underline{1.45 \times \sqrt{2}} \times 56 \times 10^{-4}$$

$$= j 3518 \text{ V}$$

$$\frac{\dot{U}_1}{\dot{U}_2} = \frac{N_1}{N_2}$$

$$\dot{U}_2 = \frac{\dot{U}_1 N_2}{N_1}$$

$$\dot{U}_2 = \frac{j 3518 \times 80}{1150}$$

$$\dot{U}_2 = j 244.73 \text{ V}$$

② 50 Hz

$$\dot{U}_1' = \left(\frac{50}{60}\right) \cdot \dot{U}_1$$

$$= \left(\frac{50}{60}\right) \cdot j 3518$$

$$= j 2931.67 \text{ V}$$

$$\dot{U}_2' = \left(\frac{50}{60}\right) \cdot \dot{U}_2$$

$$= \left(\frac{50}{60}\right) \cdot j 244.73$$

$$= j 203.94 \text{ V}$$

(2) Short-circuit:

电流为额定值, 外施电压很低, 主磁通很小, 因此可忽略励磁电流和铁耗

Open-circuit:

电压为额定值, 磁芯被完全磁化, 主磁通很大, 由于没有负载, 绕组中电流可忽略, 即 $I^2 R$ 损耗可忽略