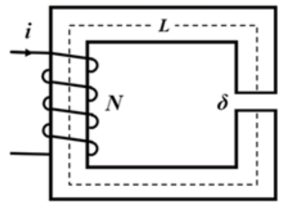
1.The magnetic circuit consists of a core material and an air-gap. The air-gap length is $\boldsymbol{\delta}$, the core length is $\boldsymbol{L}$ and the core cross-sectional area is $\boldsymbol{A}$. The turns of the coil are $\boldsymbol{N}$. Assume that the core is infinite permeability ($\mu_{Fe}=\infty$) and neglect the effects of magnetic leakage and fringing. Calculate: (1) the reluctance of the core $\boldsymbol{R}_{Fe}$ and that of the air-gap $\boldsymbol{R}_{\delta}$, (2) the inductance of coil $\boldsymbol{L}_c$, (3) the current $\boldsymbol{i}$ required to produce an air-gap flux density $\boldsymbol{B}_{\delta}$, (4) the corresponding flux linkage Ψ_c of the coil.



2. Draw the equivalent-T circuit of a transformer. When the primary voltage $\boldsymbol{U}_1$ increases, analyze the changes of main flux Φ_m, core permeability μ_{Fe}, exciting resistance $\boldsymbol{R}_m$, exciting reactance $\boldsymbol{X}_m$ and the secondary voltage $\boldsymbol{U}_2$.

3. A single-phase transformer with its secondary circuit open and an alternating voltage applied to its primary terminals. The core loss and exciting voltamperes were found to be P_{Fe}=16W S=20VA and the primary voltage was U=194V when the winding had 200 turns.Find the power factor, the core-loss current I_{Fe}, the exciting current I_m, and the magnetizing current I_μ.

4. A 50 kVA U_{1N}=2400V U_{2N}=240V 50Hz distribution transformer has a leakage impedance of 0.72+j0.92 Ω in the high-voltage winding and 0.0070+j0.0090 Ω in the low-voltage winding. At rated voltage and frequency, the impedance Z_m of the exciting branch (equal to the impedance of R_m and jX_m in series) is 6.32+j43.7Ω when viewed from the low-voltage side. Draw the equivalent circuit referred to (a) the high-voltage side and (b) the low-voltage side, and label the impedance numerically.

5. A 50 kVA U_{1N}=2400V U_{2N}=240V 50Hz distribution transformer has a leakage impedance of 0.72+j0.92 Ω in the high-voltage winding and 0.0070+j0.0090 Ω in the low-voltage winding. Find the voltage at the secondary terminals of the transformer when the load connected to its secondary draws rated current from the transformer and the power factor of the load is 0.8 **lagging**. Neglect the exciting current, and use the simplified equivalent circuit.

6. A 50 kVA U_{1N}=2400V U_{2N}=240V 50Hz distribution transformer has a leakage impedance of 0.72+j0.92 Ω in the high-voltage winding and 0.0070+j0.0090 Ω in the low-voltage winding. Determine the voltage regulation of the transformer operator at full load, 0.8 power factor lagging.

7. The voltage regulation of one transformer operator at full load is zero. Find that the power factor is lagging or leading.

8. With the instruments located on the high-voltage side and with the low-voltage side shorted-circuited, the short-circuit test reading for the 50 kVA U_{1N}=2400V U_{2N}=240V transformer are 48V 20.8A and 617 W. An open-circuit test with the low-voltage side energized gives instrument readings on the side of 240V, 5.41A, and 186W.
Find the exciting impedance Z_m = R_m+jX_m and the short-circuit impedance R_k+jX_k. Determine the voltage regulation of the transformer operator at full load, 0.8 power factor lagging.