Basic Electrical Technology

Parallel Magnetic Circuits

RECAP

- Magnetic Circuit Definitions
- Series Magnetic Circuit
- Why do we take mean length ?
- Why Air gap is considered ?
- Leakage and Fringing effect

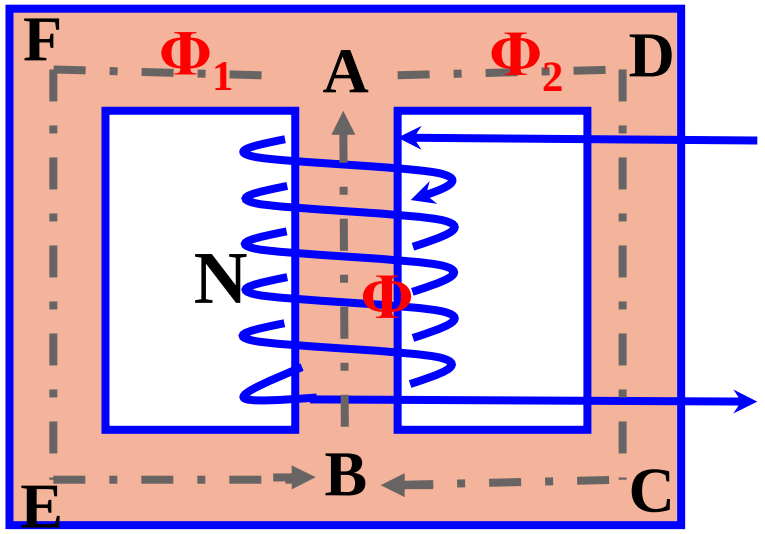
Parallel Magnetic Circuit

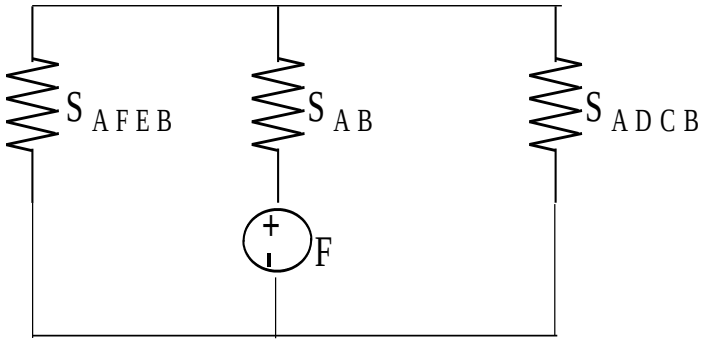
- More than one path for flux
- $\Phi = \Phi_1 + \Phi_2$

$$S_{AB} = \frac{l_{AB}}{\mu_0 \, \mu_{rAB} \, A_{AB}}$$

$$S_{ADCB} = \frac{l_{ADCB}}{\mu_0 \, \mu_{rADCB} \, A_{ADCB}}$$

$$S_{AFEB} = \frac{l_{AFEB}}{\mu_0 \, \mu_{rAFEB} \, A_{AFEB}}$$





Analogous Electrical Circuit

Parallel Magnetic Circuit…

- $(Mmf)_{Total} = (Mmf)_{AB} + (Mmf)_{ADCB}$

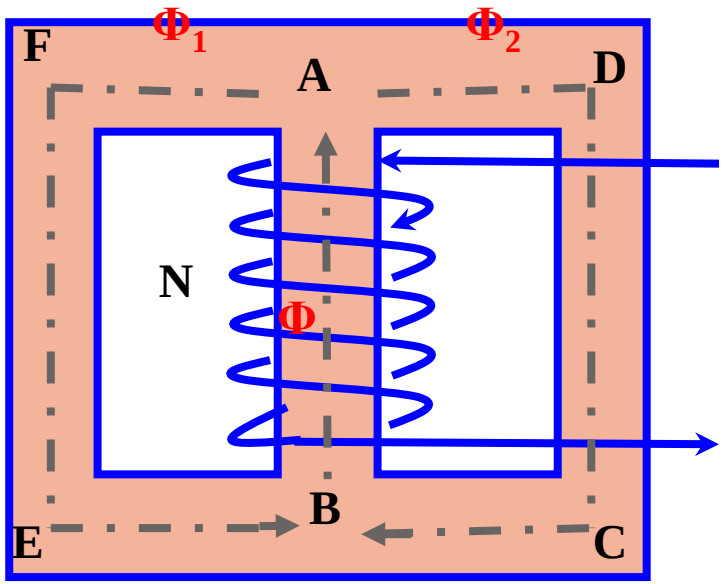
  OR

  $(Mmf)_{Total} = (Mmf)_{AB} + (Mmf)_{AFEB}$

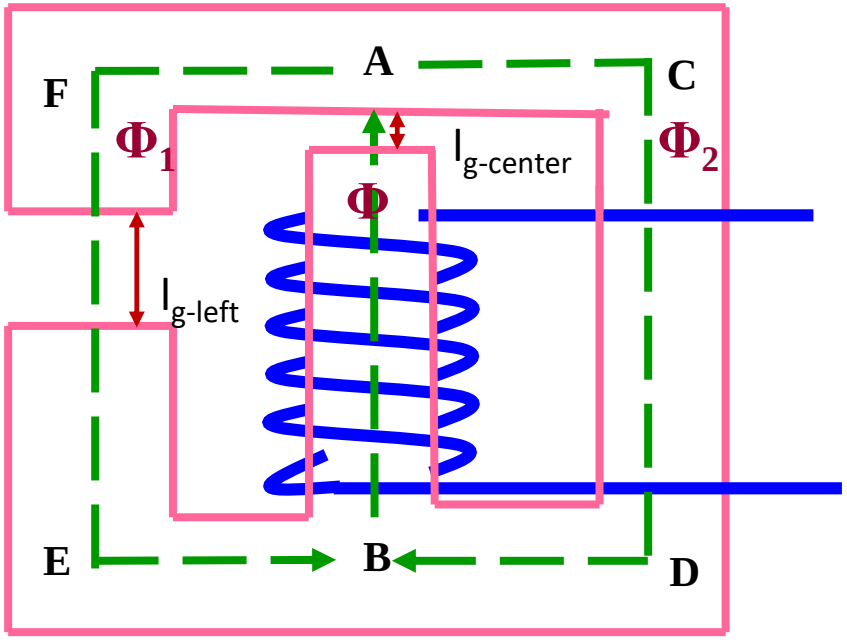
- $(Mmf)_{Total} = \Phi S_{AB} + \Phi_1 S_{ADCB}$

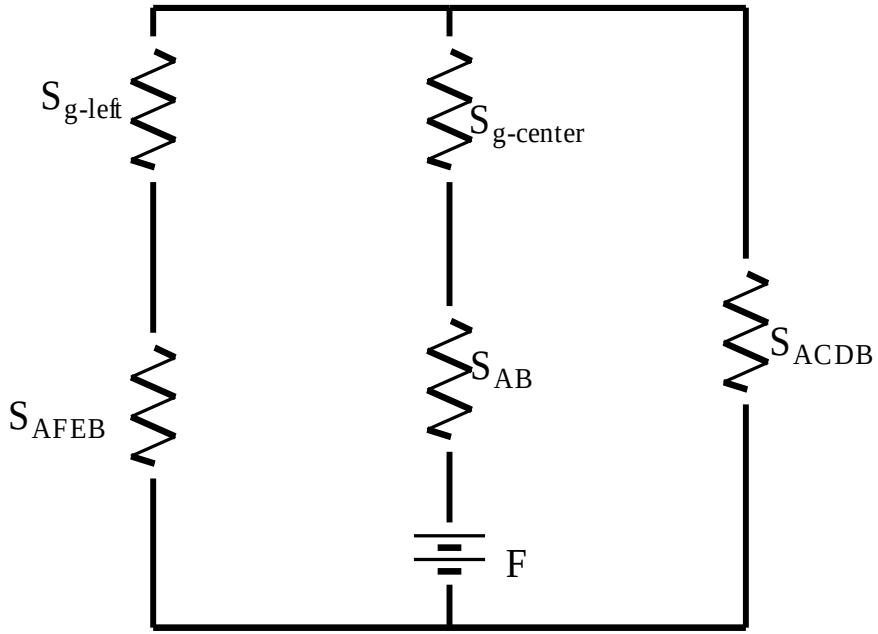
  OR

  $(Mmf)_{Total} = \Phi S_{AB} + \Phi_2 S_{AFEB}$



Parallel Magnetic Circuit with Air Gap



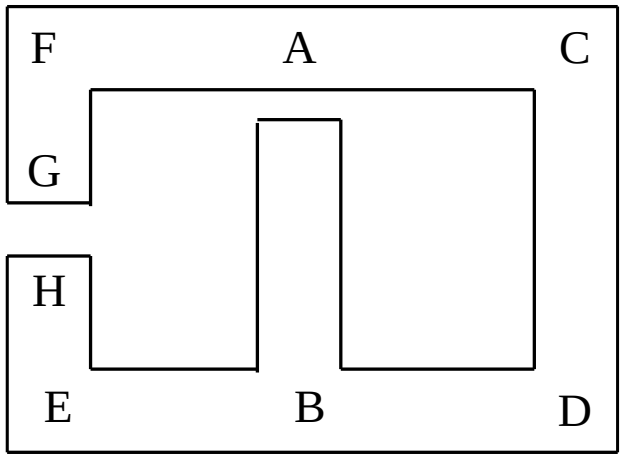


$$S_{AFEB} = \frac{(l_{AFEB} - l_{gleft})}{\mu_0 \, \mu_{rAFEB} \, A_{AFEB}}; \qquad S_{AB} = \frac{(l_{AB} - l_{gcenter})}{\mu_0 \, \mu_{rAB} \, A_{AB}}$$

Example 1

The magnetic circuit shown in Fig. is made of a material having relative permeability of 2000. The central limb is wound with 1000 turns and has an airgap of length of 2mm. The side limb airgap is 8 mm. Calculate the current required to set up a flux of 2.6 mWb in the central limb. Mean lengths of various sections are as follows:

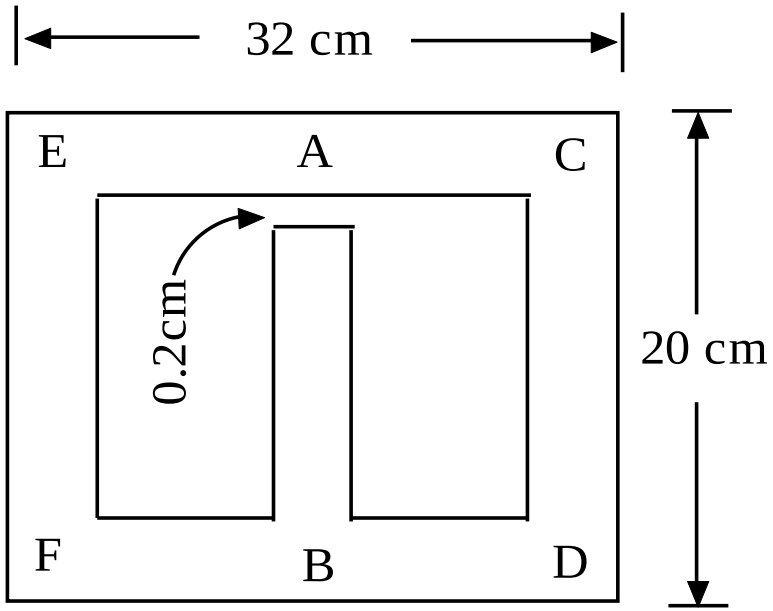
AB = 24 cm, ACDB = AFGHEB = 60 cm. Cross sectional area of the structure is 10 cm^2.



Ans: 4. 98 A

Example 2

A coil carrying a current of 2.8 A is wound on the left limb of the cast steel symmetrical frame of uniform square cross section 16 cm^2 as shown in Fig. Calculate the number of turns in the coil to produce a flux of 1.8 mWb in the air gap of 0.2 cm length. The relative permeability of cast steel is 1200.



Ans: 1480