(1)

(a) A flux density of 0.5 T in the central core corresponds to a total flux of

$$\phi_{\text{TOT}} = BA = (0.5\ \text{T})(0.05\ \text{m})(0.05\ \text{m}) = 0.00125\ \text{Wb}$$

By symmetry, the flux in each of the two outer legs must be $\phi_1 = \phi_2 = 0.000625\ \text{Wb}$, and the flux density in the other legs must be

$$B_1 = B_2 = \frac{0.000625\ \text{Wb}}{(0.05\ \text{m})(0.05\ \text{m})} = 0.25\ \text{T}$$

The magnetizing intensity *H* required to produce a flux density of 0.25 T can be found from Figure 1-10*c*. It is 50 A·t/m. Similarly, the magnetizing intensity *H* required to produce a flux density of 0.50 T is 75 A·t/m. The mean length of the center leg is 21 cm and the mean length of each outer leg is 63 dm, so the total MMF needed is

$$\mathcal{F}_{\text{TOT}} = H_{\text{center}}\, l_{\text{center}} + H_{\text{outer}}\, l_{\text{outer}}$$
$$\mathcal{F}_{\text{TOT}} = (75\ \text{A}\cdot\text{t/m})(0.21\ \text{m}) + (50\ \text{A}\cdot\text{t/m})(0.63\ \text{m}) = 47.3\ \text{A}\cdot\text{t}$$

and the required current is

$$i = \frac{\mathcal{F}_{\text{TOT}}}{N} = \frac{47.3\ \text{A}\cdot\text{t}}{400\ \text{t}} = 0.12\ \text{A}$$

(b) A flux density of 1.0 T in the central core corresponds to a total flux of

$$\phi_{\text{TOT}} = BA = (1.0\ \text{T})(0.05\ \text{m})(0.05\ \text{m}) = 0.0025\ \text{Wb}$$

By symmetry, the flux in each of the two outer legs must be $\phi_1 = \phi_2 = 0.00125\ \text{Wb}$, and the flux density in the other legs must be

$$B_1 = B_2 = \frac{0.00125\ \text{Wb}}{(0.05\ \text{m})(0.05\ \text{m})} = 0.50\ \text{T}$$

The magnetizing intensity *H* required to produce a flux density of 0.50 T can be found from Figure 1-10*c*. It is 75 A·t/m. Similarly, the magnetizing intensity *H* required to produce a flux density of 1.00 T is about 160 A·t/m. Therefore, the total MMF needed is

$$\mathcal{F}_{\text{TOT}} = H_{\text{center}} l_{\text{center}} + H_{\text{outer}} l_{\text{outer}}$$
$$\mathcal{F}_{\text{TOT}} = (160\ \text{A}\cdot\text{t/m})(0.21\ \text{m}) + (75\ \text{A}\cdot\text{t/m})(0.63\ \text{m}) = 80.8\ \text{A}\cdot\text{t}$$

and the required current is

$$i = \frac{\phi_{\text{TOT}}}{N} = \frac{80.8\ \text{A}\cdot\text{t}}{400\ \text{t}} = 0.202\ \text{A}$$

This current is *not* twice the current in part *(a)*.

(c) The reluctance of the central leg of the core under the conditions of part *(a)* is:

$$\mathcal{R}_{\text{cent}} = \frac{\mathcal{F}_{\text{TOT}}}{\phi_{\text{TOT}}} = \frac{(75\ \text{A}\cdot\text{t/m})(0.21\ \text{m})}{0.00125\ \text{Wb}} = 12.6\ \text{kA}\cdot\text{t/Wb}$$

The reluctance of the right leg of the core under the conditions of part *(a)* is:

$$\mathcal{R}_{\text{right}} = \frac{\mathcal{F}_{\text{TOT}}}{\phi_{\text{TOT}}} = \frac{(50\ \text{A}\cdot\text{t/m})(0.63\ \text{m})}{0.000625\ \text{Wb}} = 50.4\ \text{kA}\cdot\text{t/Wb}$$

(d) The reluctance of the central leg of the core under the conditions of part *(b)* is:

$$\mathcal{R}_{\text{cent}} = \frac{\mathcal{F}_{\text{TOT}}}{\phi_{\text{TOT}}} = \frac{(160\ \text{A}\cdot\text{t/m})(0.21\ \text{m})}{0.0025\ \text{Wb}} = 13.4\ \text{kA}\cdot\text{t/Wb}$$

The reluctance of the right leg of the core under the conditions of part *(b)* is:

$$\mathcal{R}_{\text{right}} = \frac{\mathcal{F}_{\text{TOT}}}{\phi_{\text{TOT}}} = \frac{(75\ \text{A}\cdot\text{t/m})(0.63\ \text{m})}{0.00125\ \text{Wb}} = 37.8\ \text{kA}\cdot\text{t/Wb}$$

(e) The reluctances in real magnetic cores are not constant.

注：这里的 right leg 指全部，包括上下的部分