Homework set 7 (David K. Cheng, Fundamentals of Engineering Electromagnetics)

P. 5-13 A ferromagnetic sphere of radius b is magnetized uniformly with a magnetization $\mathbf{M} = \mathbf{a}_z M_0$.

a) Determine the equivalent magnetization current densities $\mathbf{J}_{m\upsilon}$ and $\mathbf{J}_{ms}$.

b) Determine the magnetic flux density at the center of the sphere.

P. 5-15 Determine the self-inductance of a toroidal coil of N turns of wire wound on an air frame with mean radius r_0 and a circular cross section of radius b. Obtain an approximate expression assuming $b \ll r_0$.

P. 5-17 Find the mutual inductance between two coplanar rectangular loops with parallel sides, as shown in Fig. 5-28. Assume that $h_1 \gg h_2 (h_2 > w_2 d)$.

P. 5-19 The cross section of a long thin metal strip and a parallel wire is shown in Fig. 5-30. Equal and opposite currents I flow in the conductors. Find the force per unit length on the conductors.

P. 5-21 A d-c current $I = 10$ (A) flows in a triangular loop in the xy-plane as in Fig. 5-32. Assuming a uniform magnetic flux density $\mathbf{B} = \mathbf{a}_y 6(mT)$ in the region, find the forces and torque on the loop. The dimensions are in (cm).