Problem 2.1 (Problem 1.1 p. 47)

Answers:
(a) $R_c = 0 \text{ H}^{-1}$, $R_g \approx 5.46 \times 10^6 \text{ H}^{-1}$, (b) $\phi = 24.4 \mu \text{Wb}$, (c) $\lambda \approx 2.32 \text{ mWb-t}$, (d) $L \approx 1.65 \text{ mH}$

Problem 2.2 (Problem 1.2 p. 48)

Answers:
(a) $R_c \approx 0.242 \times 10^6 \text{ H}^{-1}$, $R_g \approx 5.46 \times 10^6 \text{ H}^{-1}$, (b) $\phi \approx 23.3 \mu \text{Wb}$, (c) $\lambda \approx 2.22 \text{ mWb-t}$, (d) $L \approx 1.58 \text{ mH}$

Problem 2.3 (Problem 1.13 p. 50)

Answers:
(a) $l_c \approx 0.229 \text{ m}$, $A_c = 1.62 \text{ cm}^2$, (b) $R_c = 0 \text{ H}^{-1}$, $R_g \approx 7.37 \times 10^6 \text{ H}^{-1}$, (c) $L \approx 0.704 \text{ mH}$, (d) $i = 20.7 \text{ A}$, (e) $\lambda = 14.6 \text{ mWb-t}$

Problem 2.4

The above figure shows the cross-section of an electromechanical device with a fixed center core and two movable parts. All three pieces of this magnetic structure are made from an infinitely permeable material. A variable current source $i(t)$ drives the terminals of the N-turn coil. Neglect leakage and fringing effects in this problem.
(a) Find an expression for the magnetic flux linkages $\lambda$ in the form $\lambda = \lambda(i, x, y) = L(x, y)i$ where $L(x, y)$ is the coil inductance which is a function of both displacements $x$ and $y$.
(b) Find the voltage $v(t)$ induced at the electrical terminals of the N-turn coil when all three variables $i(t)$, $x(t)$ and $y(t)$ are varying with time.

Partial Answer:

(a) $L(x, y) = \frac{\mu_0 d(bx + ay) N^2}{2xy}$