

ECE 330 HW #5

In class quiz – Friday, Mar 1.

Copies of the textbook are kept at the Grainger Engineering Library Reserve

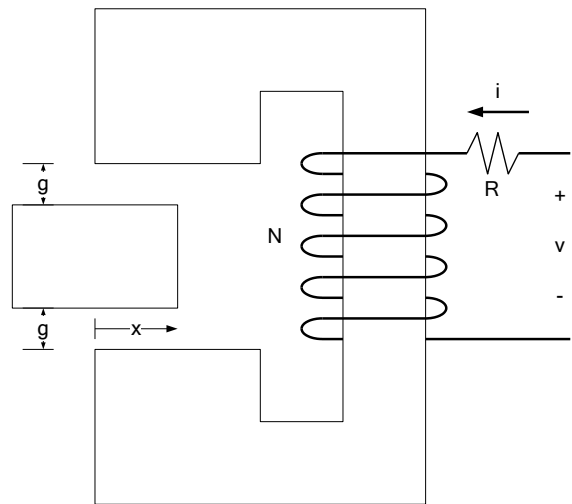
Text problem 4.1 (a) and (b) only

Text problem 4.2 (a) only (partial solution: $L_1 = (1/4) * (\mu_0 N^2 N^2 ((A_{g0}/g_0) + (A_{g1}/g_1)))$)

Special problem #1 (see Exam 2 Spring 2004 for solution)

For the structure drawn in Figure 1 below, the movable member is constrained to move left and right only as indicated in the figure where “x” is the distance to the right edge of the movable member. The large member with the coil is fixed, and the depth into the page for both members is 2cm. The gap g is 1mm, and the number of turns $N = 100$. Find:

- Total reluctance of the main flux path (through the two gaps).
- Flux linkage, λ . (defined for the voltage polarity shown)
- An expression for the voltage, v.



Express all of these as functions of current and/or position (x) and/or velocity and/or time as appropriate. You may neglect fringing in the gap, and you may assume the iron is infinitely permeable. Both current i and distance x are functions of time.

Special problem #2

For the electromagnetic circuit shown below, find an expression for the voltage $v(t)$ of the coil in terms of the cross-sectional area of the external iron path (A_g), the cross-sectional area of the center piece (A_x), the gap length, the permeability of free space (in the two gaps and in the space denoted by the distance $x(t)$), the number of turns N , the current $i(t)$ and the distance $x(t)$ shown in the figure. Neglect the reluctance of the iron and neglect the fringing.

