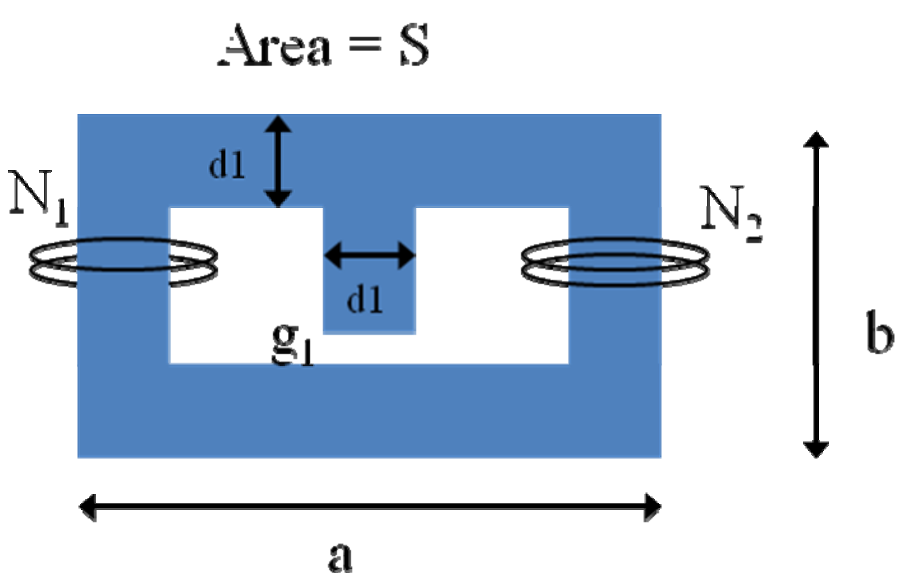
Fields and Waves I
Homework 6
ECSE 2100 Fall 2008

The magnetization curve of B(H) for a ferromagnetic material was measured and was found to be of the form $B(H) = \frac{B_0 H}{H_0 + H}$. This is called the Frolich approximation. The coefficients are B_0 = 1.37T and H_0 = 64 A/m. A thin torus with mean radius R = 10 cm and a cross section of A = 1 cm^2, is made of this material. N = 500 turns are wound uniformly around the core. Find the flux through the core for a) I = 0.25A, b) I = 0.5 A, c) I = 0.75 A and d) I = 1.0A. For the thin core you can assume that B is constant over the cross section.

Find the number of turns ($N_1 = N_2 = N$) in the magnetic circuit below so that the flux density in the air gap is 1.0T for $I_1 = I_2$ = 5.0 A. The core is made of the same material as in problem 1. Use a = 10 cm, b = 6 cm., d1 = 2 cm., g_1 = 1.0 mm., and S = 4 cm^2. Solve the problem 2 ways, first taking the magnetic permeability of the core into account and second neglecting the magnetic resistance (reluctance) of the core. Find the % difference between the 2 results.



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We are frequently interested in the interference of one circuit with another. For example, consider the power line (two wire transmission line) carrying 1000 Amperes in each conductor (opposite directions of course). Parallel to these conductors is a communication right of way as shown. Find the flux linking the telephone circuit per meter depth due to the power line current.