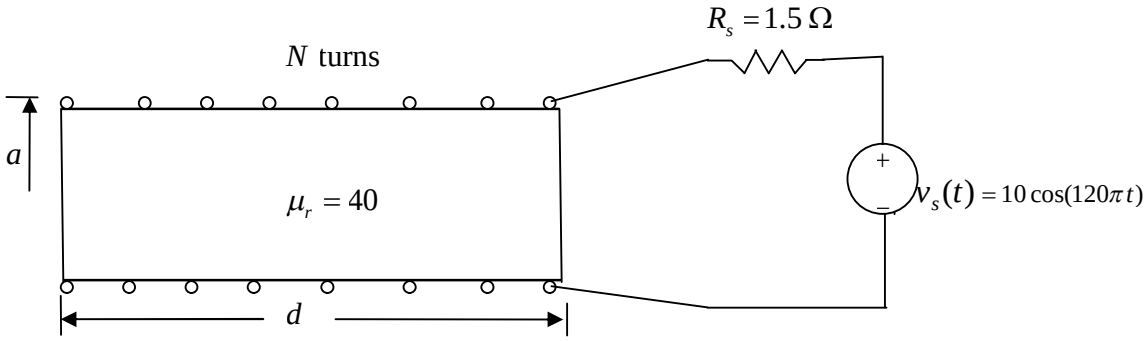
EE 340 (04) Design Project (072)

The diagram below shows a solenoidal inductor of length $d = 10cm$ and a circular cross-sectional area of radius $a = 0.2cm$. The core is made of a material with a relative permeability $\mu_r = 40$. The solenoidal inductor has N turns of *negligibly-thin* conducting wire, which is wrapped uniformly around the solenoidal core. The resistance per *unit length* of this wire is $\overline{R} = 0.1\Omega / m$.

An AC magnetic field is generated in the core by directly connecting the coil to a *practical* 60Hz, A.C. voltage source $V_s = 10\cos(120\pi t)\,V$ with an internal resistance $R_s = 1.5\Omega$.



Design a suitable circuit (by calculating the number of turns N) that results in the *maximum* possible B field (maximum magnitude) inside the core of the solenoidal inductor.

[Hint: Develop a circuit model and analyze it using sinusoidal steady state phasor analysis].

Other Requirements:

1- Show all work in detail including derivation of the necessary relations and clearly indicate any assumptions that you made with justification.
2- Summarize your results in the table provided below.
3- Work Alone. You can only discuss the design project with the course instructor, as much as you like. **An automatic zero will be given if this rule is violated**.
4- The report must be type-written and neatly prepared.
5- Deadline for project submission is Wednesday, May 28, 2008.

Design Summary

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