Homework9

Problem 1: L for a solenoid

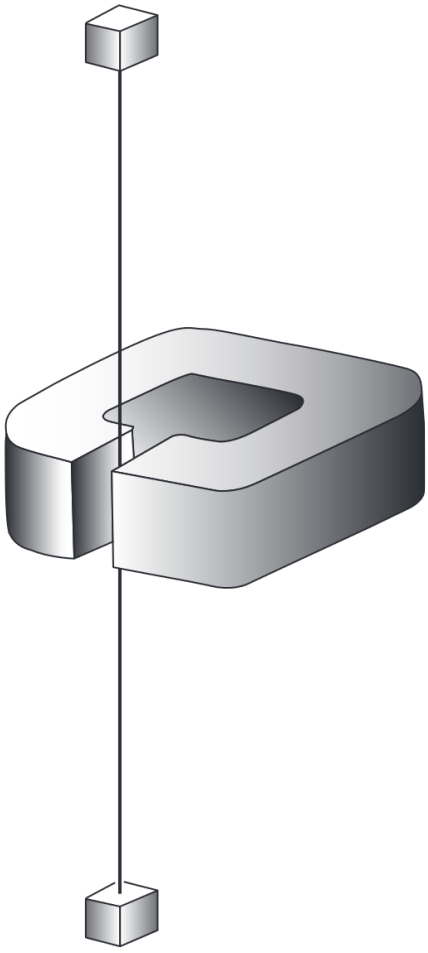
Find the self-inductance of a long solenoid with radius r, length ℓ, and N turns.

Problem 2: Maximum emf

What is the maximum electromotive force induced in a coil of $4000\ \mathrm{turns}$, average radius $12\ \mathrm{cm}$, rotating at 30 revolutions per second in the earth's magnetic field where the field intensity is $0.5\ \mathrm{Gs}$? ($1\ \mathrm{T} = 10000\ \mathrm{Oe} = 10000\ \mathrm{Gs}$)

Problem 3: Vibrating wire

A taut wire passes through the gap of a small magnet (Figure below), where the field strength is $5000\ \mathrm{Gs}$. The length of wire within the gap is $1.8\ \mathrm{cm}$. Calculate the amplitude of the induced alternating voltage when the wire is vibrating at its fundamental frequency of $2000\ \mathrm{Hz}$ with an amplitude of $0.03\ \mathrm{cm}$, transverse to the magnetic field.

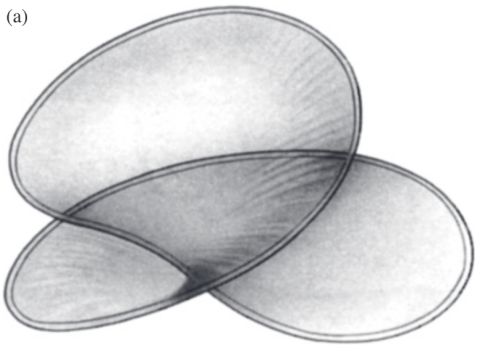


Problem 4: A loop with two surfaces

Consider the loop of wire shown in Figure below. Suppose we want to calculate the flux of $\vec{B}$ through this loop. Two surfaces bounded by the loop are shown in parts (a) and (b) of the figure. What is the essential difference between them? Which, if either, is the correct surface to use in performing the surface integral $\int \vec{B} \cdot d\vec{a}$ to find the flux? Describe the corresponding surface for a three-turn coil. Show that this is all

consistent with our previous assertion that, for a compact coil of N turns, the electromotive force is just N times what it would be for a single loop of the same size and shape.

(a)



(b)