8.02 ESG Independent Study

Unit 12: Inductance

In the previous unit, we saw that Faraday's law of induction predicts that an EMF will be produced in a circuit in the presence of a changing magnetic field. But, you may ask, couldn't the current in the circuit itself, which we know creates a magnetic field, be changing, thus inducing an EMF in that same circuit? Of course it could; this property is know as self-inductance, and is the primary subject of this unit.

An inductive circuit tends to prevent abrupt changes in current, and you might expect that it requires work to build up a current. This is indeed the case, and we associate an energy with an inductor which is proportional to the square of the current. Analogous to what was seen with capacitors, this energy will be interpreted as being due to an energy *density* proportional to the square of the magnetic field strength.

Objectives: After completing this unit, you should be able to compute inductances for simple circuit configurations, describe the behaviour of inductive circuits both qualitatively and quantitatively, and determine the energy associated with inductors and magnetic fields.

Suggested Procedure:

1. Read sections 30.1 through 30.3 in UP11. Again, the rest of the chapter will be used later. Suggested problems include 1, 5, 15, 17, 45, 50.

   or,

2. Read the rest of chapter seven in Purcell, sections 6–10. The meat is in sections 8–10, so don't be fooled by their brevity. Suggested problems include pp. 286–294, #s 11, 13, 21, 23, 25, 28, 29 (the last is a good one).

3. Take a unit test.