Handouts: Syllabus & Schedule, HW1, Why Study EM
Please be sure you review the Syllabus.

What is Electromagnetics?

In your previous experience in electrical engineering, you have learned about and experimented with electricity … connect one end of a wire to a voltage, and that voltage appears on the other end of the wire.

You have studied a number of devices (resistors, transistors, capacitors, op amps, etc.) … and in order to make "connections" between them, you have had to be certain that they were solidly connected by wire/solder/metal.

Electromagnetics is different. Electromagnetic waves move through the air and transfer power and energy without having any physical connection.

Obvious Examples: Radio signals, microwave oven, Cellular Telephone

Less Obvious Examples: Capacitor, Inductor, motor/generator

Gotchas: All circuits radiate. Problems occur at high frequency and/or high power. What happens? Invisible but very real "shorts" occur through the air. Problems in all high frequency circuits, HF computers, etc.

What other waves travel "wireless"? Are they EM? Yes, same theory applies.

- Light (laser)
- Sound (acoustic)
- Xray (ionizing)

Applications:

- Medical – hyperthermia, electrotherapy (active devices, not permanent magnets), cardiac pacemakers and defibrillators, medical imaging (ultrasound, Magnetic Resonance imaging, Tomography)
- Remote Sensing – atmospheric, radar, geophysical prospecting, medical imaging, properties of materials
- Communication – prime use, rapidly expanding – wireless devices, GPS, satellite communication.
- More: HW1 Find as many EM applications as you can. Prize!

Jobs and Skills:

- RF Design Engineers – Design RF circuits (RFICs!) (similar to ASIC circuit design ideas, but with consideration and design for fringing

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effect. … Show RF circuit.

- RF Systems Engineer – Understand RF components AND systems AND signal processing. Take prefab RF parts, and combine them to create working RF systems.
- Antenna Design Engineer – Design wide variety of antennas … EVERYTHING radiates.
- RF Test Engineers – RF equipment is very different from regular lab equipment.
- RF Software Engineers – Simulation of RF systems/devices/components/interactions, software for wireless communication

What controls EM waves?

- Location/proximity
- Frequency
- Material properties (reflection/transmission ; conductors/dielctrics)
- Other EM waves

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