EE 194 RF: Lecture 1

- Importance of RF circuit design
  - wireless communications (explosive growth of cell phones)
  - global positioning systems (GPS)
  - computer engineering (bus systems, CPU, peripherals exceeding 600 MHz)

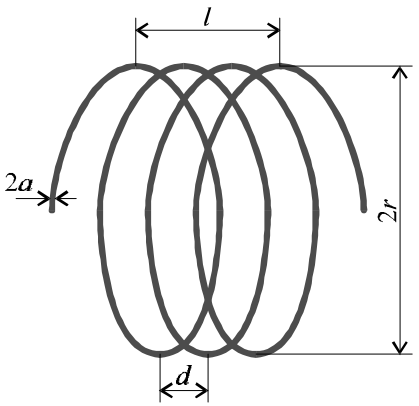
- **Why this course???**
  - lumped circuit representation no longer applies!

What do we mean by going from lumped to distributed theory?

- Example: INDUCTOR

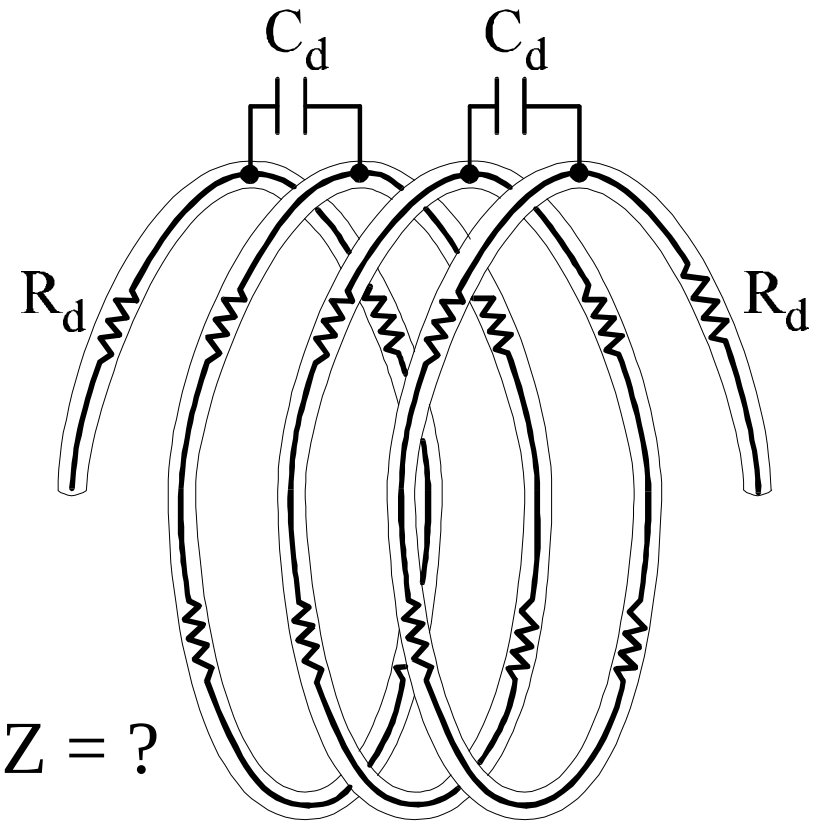
Low-frequency

(lumped)



$$Z = R + jwL$$

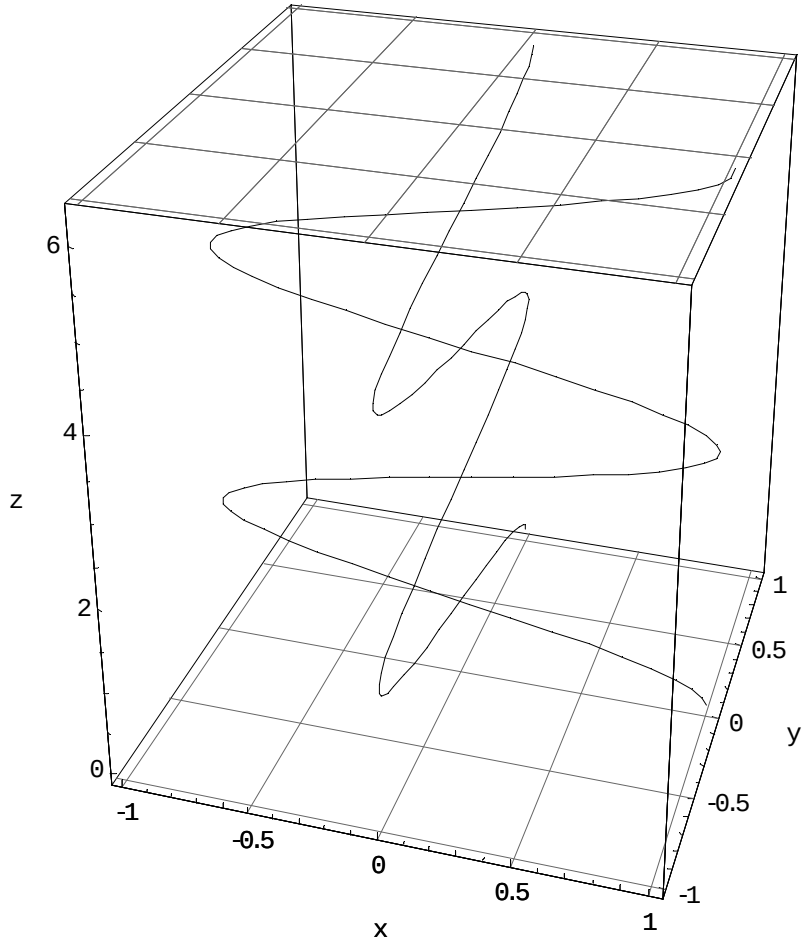
High-frequency



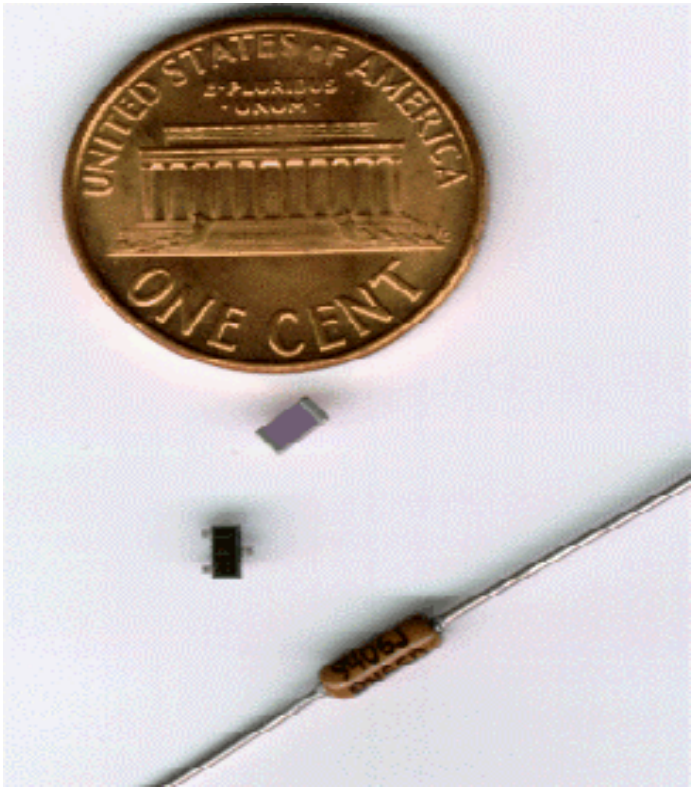
Z = ?

Current and voltage vary spatially over the component size

E (or V) and H (or I) fields



Upper MHz to GHz range

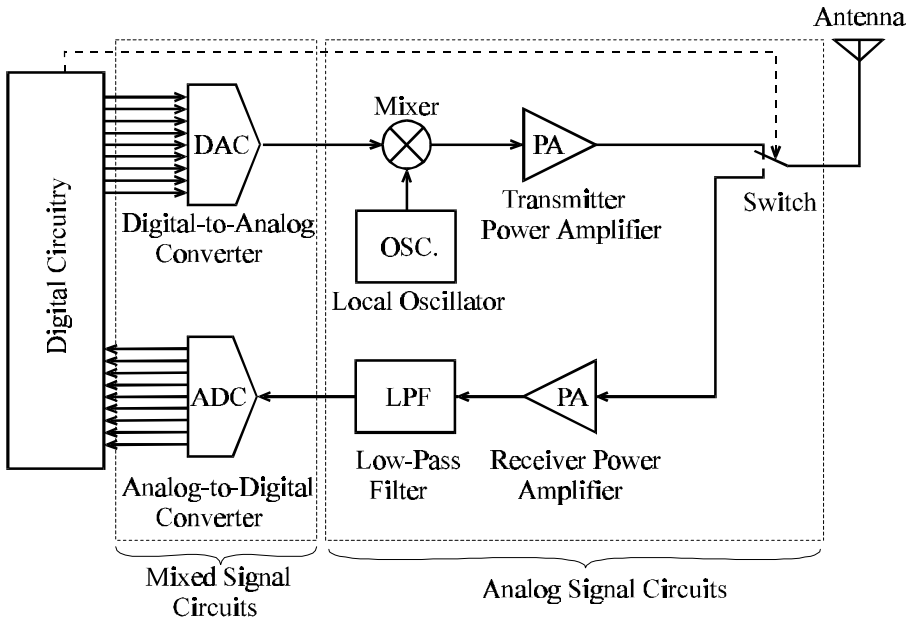


Frequency spectrum

- RadioFrequency (RF)
  - TV, wireless phones, GPS
  - 300 MHz … 3 GHz operational frequency
  - 1 m … 10 cm wavelength in **air**
- MicroWave (MW)
  - RADAR, remote sensing
  - 8 GHz … 40 GHz operational frequency
  - 3.75 cm …7.5 mm wavelength in **air**

Design Focus

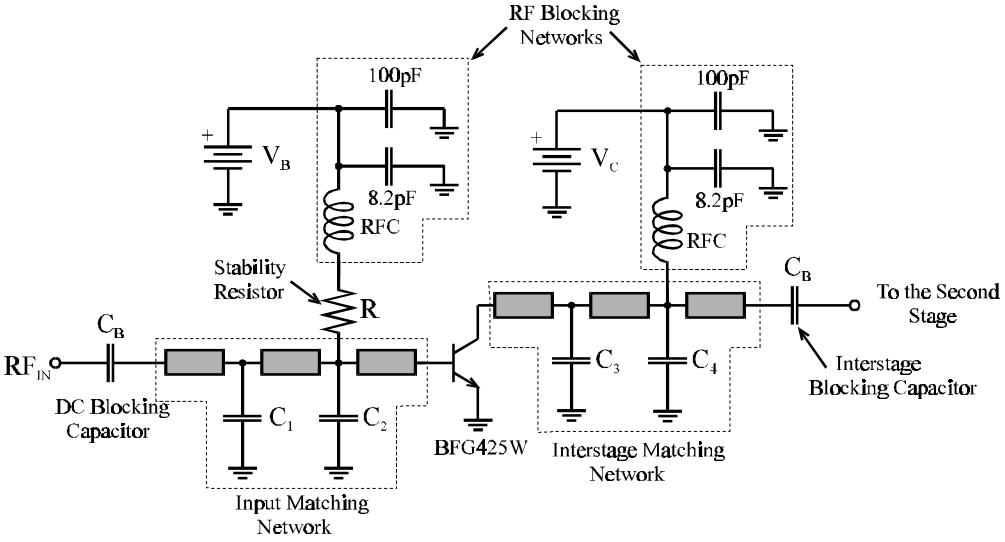
Cell phone transceiver circuit



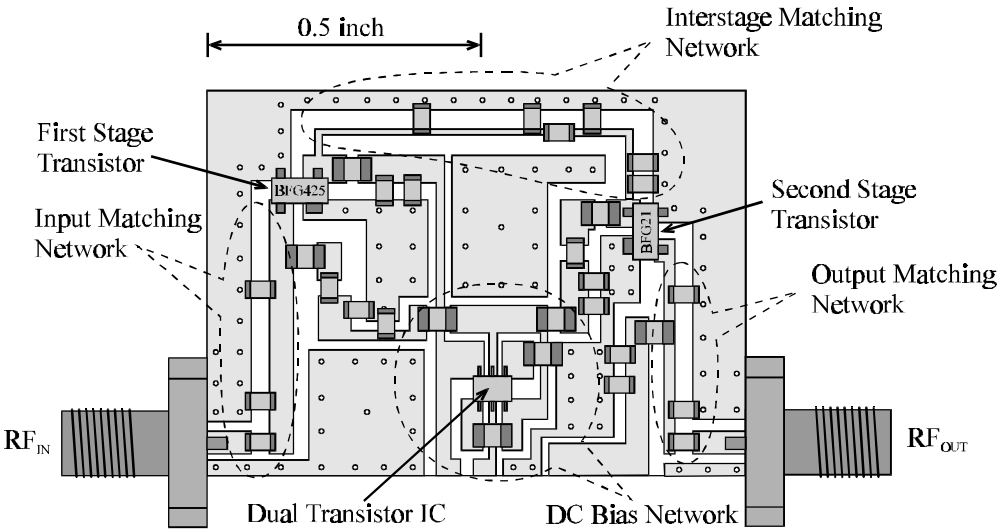
Typical frequency range:

- 950 MHz
- 1.9 GHz

Implementation



- matching networks
- BJT/FET active devices
- biasing circuits



- printed circuit board
- mircostripline realization
- surface mount technology