BINGHAMTON UNIVERSITY
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EECE 301
Signals & Systems

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Note Set #1

- What ***is*** "Signals & Systems" all about???

Do All EE's & CoE's Design Circuits?

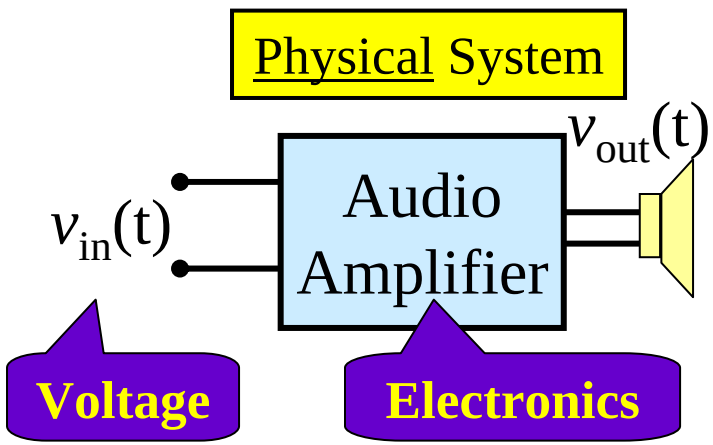
- No!!!! Someone has to figure out what function those circuits need to do
- Someone also needs to figure out the "algorithms" needed (i.e., mathematical computer processing)
- Someone also needs to figure out what the whole system needs to do

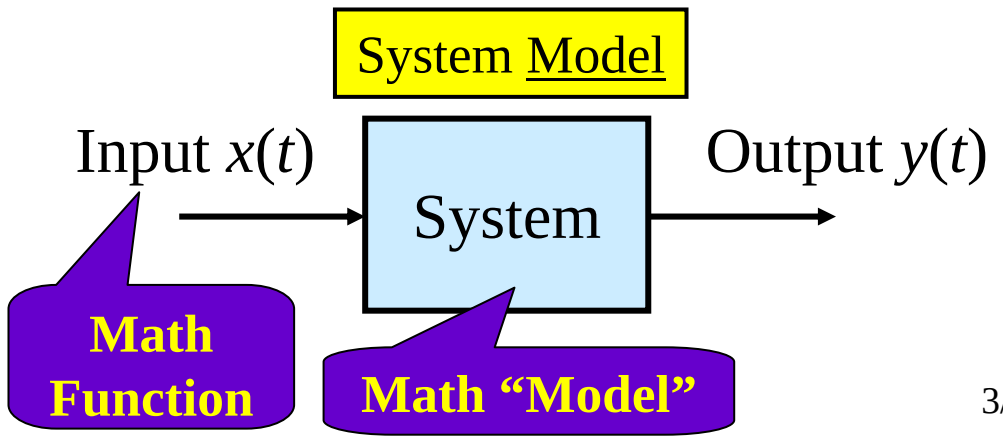
So… lots of EEs/CoEs don't design circuits at all…
What they do instead is design the **systems & algorithms** that are needed to accomplish certain needed tasks

Rely Heavily on Mathematical Models

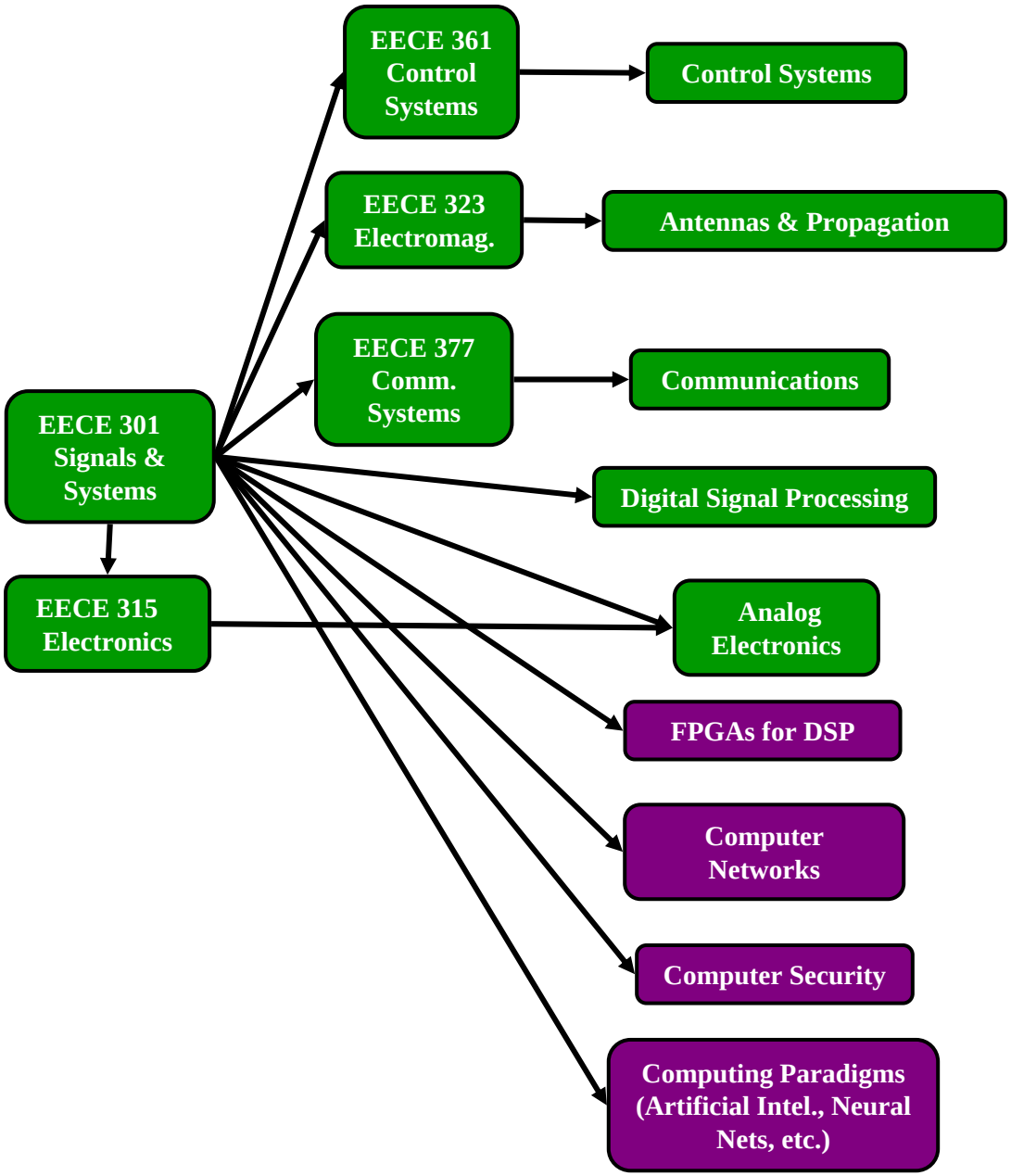
Signals & Systems

- Because most "systems" are driven by "signals" EEs & CoEs study what is called "Signals & Systems"
- **"Signal"** = a time-varying voltage (or other quantity) that generally carries some information
- The job of the **"System"** is often to extract, modify, transform, or manipulate that carried information
- So… a big part of **"Signals & Systems"** is using **math models** to see what a system "does" to a signal





Beyond “Signals & Systems”



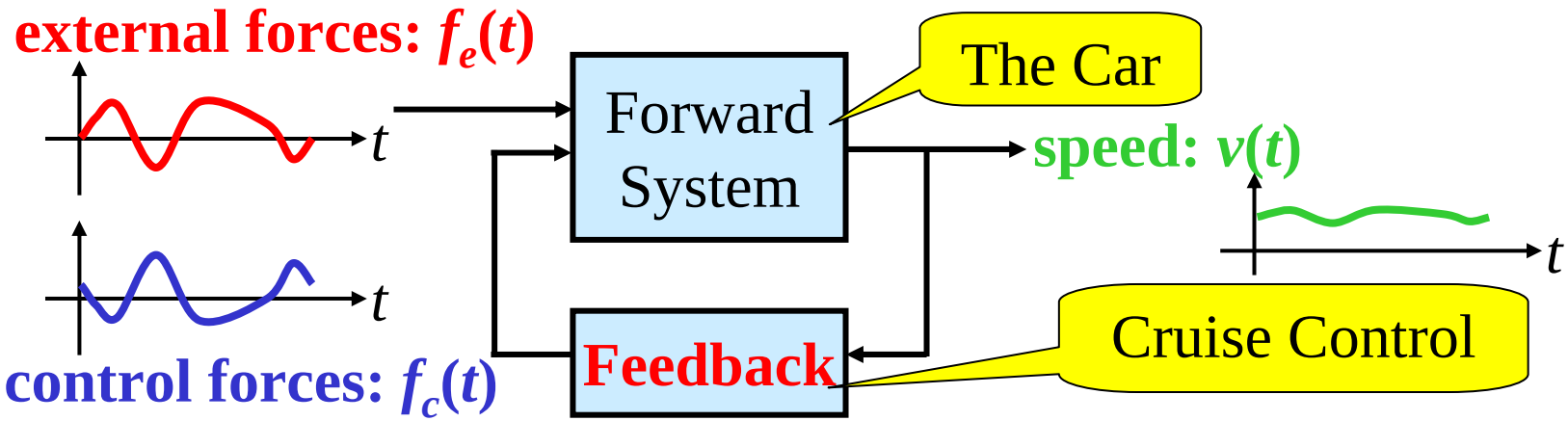
Some Application Areas

From Table 32.1 in *Electrical Engineering Uncovered*, 2nd Ed. by White & Doering

Application Area	Specific Uses of Signals & Systems
Telecommunications	Answering machines, modems, fax machines, cell phones, speaker phones
Speech and Audio	Voice mail, speaker verification, synthetic speech, audio compression (e.g., mp3)
Automotive	Engine control, antilock braking systems, active suspension, airbag control, system diagnosis
Medical	Hearing aids, remote monitoring, ultrasound imaging, magnetic resonance imaging (MRI)
Image Processing	3D animation, image enhancement, image compression (JPEG), video compression (MPEG), high-definition TV
Control Systems	Head positioning in disk drives, laser control (e.g., printers, CD/DVD drives), engine & motor control, robots
Military & Aerospace	Radar & sonar, navigation systems (e.g., GPS), secure communications, missile guidance, battlefield sensors

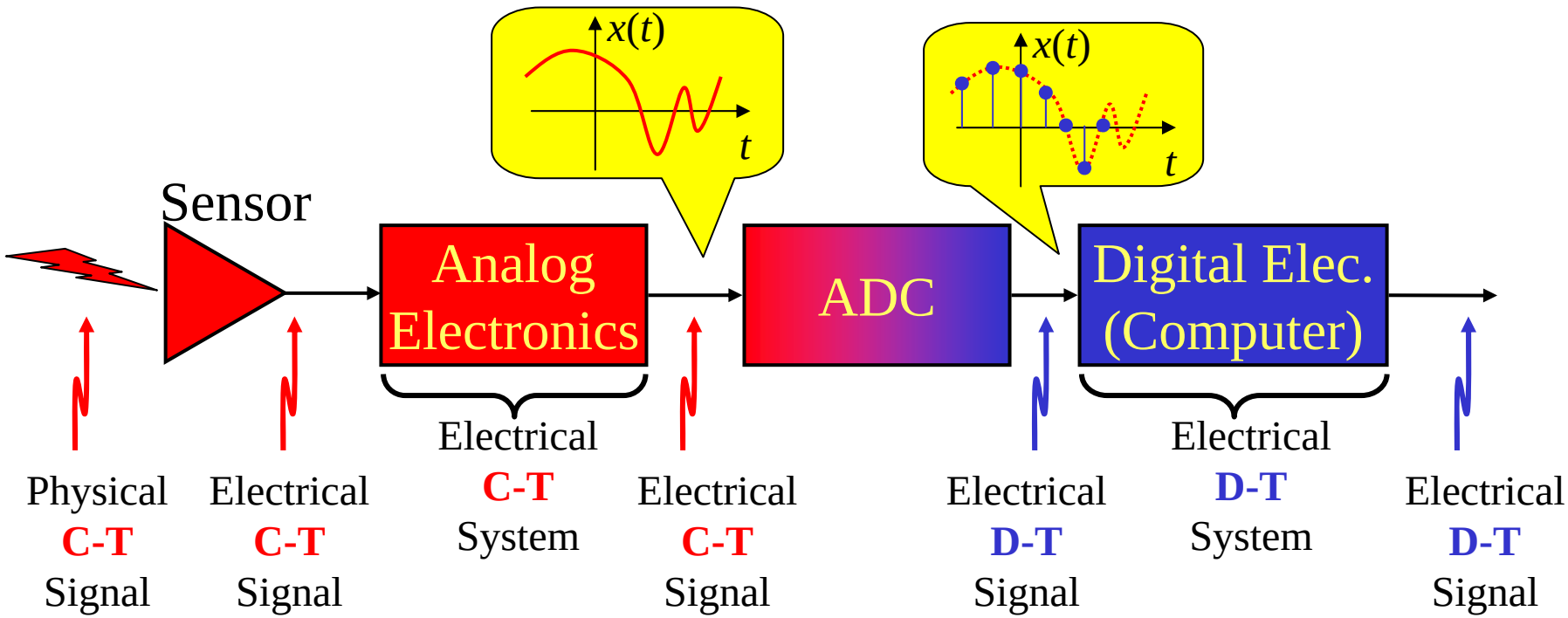
In each of these areas you can't build the electronics until your math models tell you what you need to build

- **Five Common Signals & Systems Scenarios**:
  - Given a system, determine a signal that will pass through it well
    - e.g., Communication Transmitter
  - Given a type of signal, design a system that will pass it well
    - e.g., Audio Amplifier
  - Design a system that will make a desired change to a signal
    - e.g., Audio Equalizer
  - Design a system that will extract desired info from a signal
    - e.g., Radar System or Communication Receiver
  - Design a system (and maybe signal) that gives a desired output
    - e.g., Control System…. such as cruise control for a car



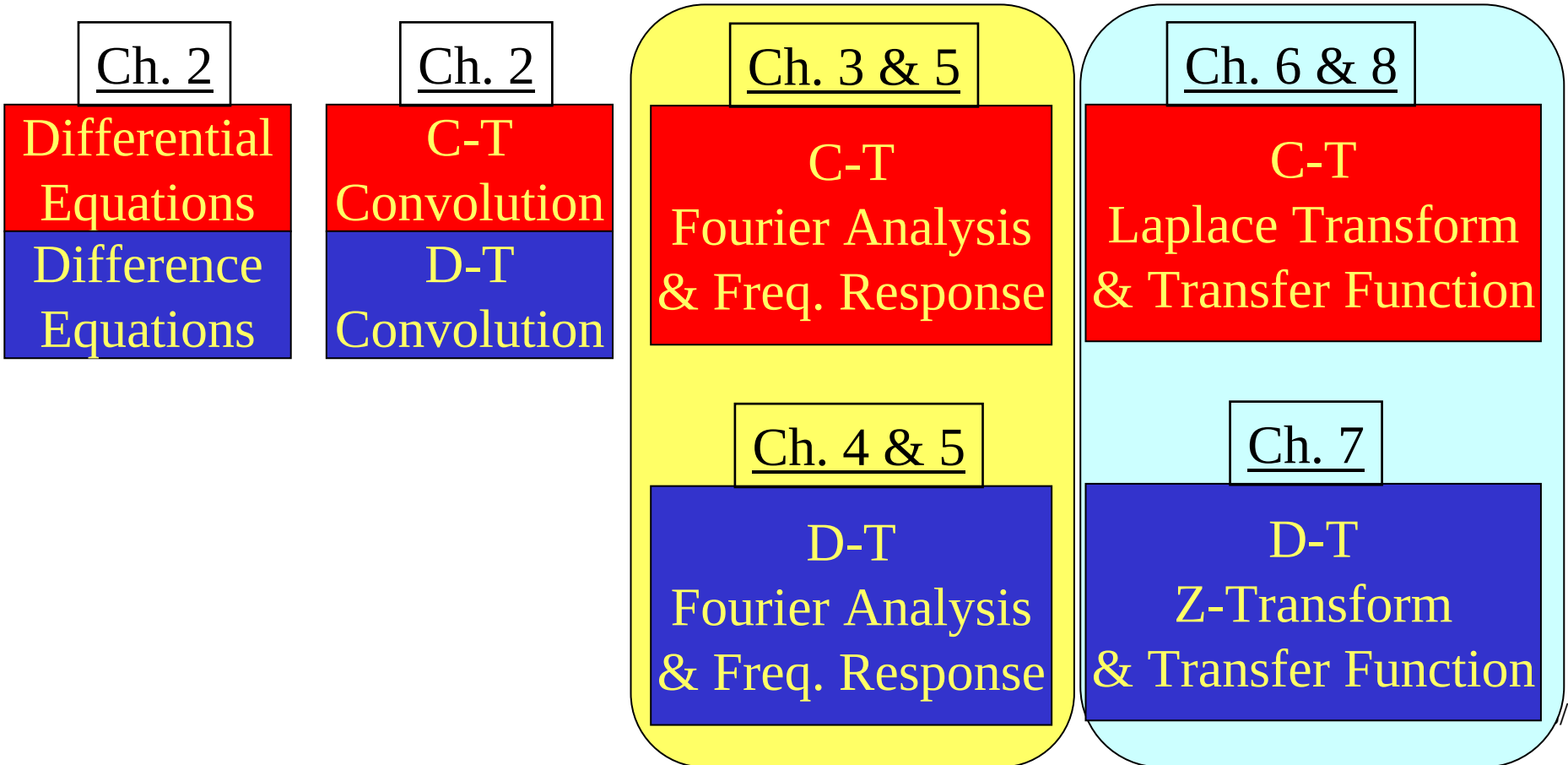
Continuous-Time & Discrete-Time

- Modern systems generally…
  - get a **continuous-time signal** from a sensor
  - a **cont.-time system** modifies the signal
  - an "analog-to-digital converter" (ADC or A-to-D) sample the signal to create a **discrete-time signal** … a "stream of numbers"
  - A **discrete-time system** to do the processing
  - and then (if desired) convert back to analog (not shown here)



Our Studies

- Because there are many similarities between C-T and D-T signals and systems…
  - We will present many ideas "side-by-side"
  - You'll need to recognize the differences/similarities



Course Flow Diagram (The Capital Letters Show Order of Coverage)

The arrows here show conceptual flow between ideas. Note the parallel structure between the pink blocks (C-T Freq. Analysis) and the blue blocks (D-T Freq. Analysis).