SIMON FRASER UNIVERSITY
School of Engineering Science
ENSC 320 Electric Circuits II

# 0. WHAT IS THIS COURSE ABOUT?

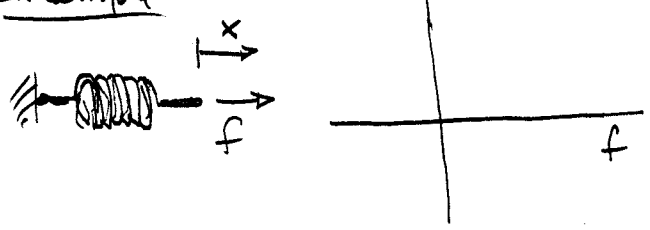
- ENSC 320 Electric Circuits II is a companion course to ENSC 380 Linear Systems. Together, they have three objectives:
  - to introduce you to a variety of basic physical phenomena of importance to engineering, such as electrical, mechanical, thermal, magnetic, financial, ...
  - to develop models and analysis methods that help you understand the behaviour of systems structured on the phenomena
  - to develop your design skills, so you can employ these phenomena in your projects.

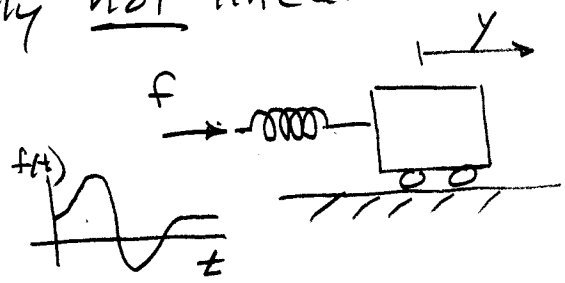
- Topics are split between 380 and 320, but there is much cross reference.
  - ENSC 380 is the principal linear systems course (continuous and discrete time, Fourier and z transforms) — it's the platform for advanced study of control systems, communications and signal processing
  - ENSC 320 has more limited scope. Most phenomena are electrical or electromagnetic. Continuous time only, and the primary analytical tools are differential equations and Laplace transform (to be folded back into 380). Along the way:
    - → Learn how to build filters (passive and active
    - → Build intuition on how systems respond, so you can design for desired behaviour
    - → Pick up down-to-earth stuff on transformers, 3-phase power, two-port networks, ...

- Before we get going, take a step backward for perspective. ENSC 320, 380 deal mostly with <u>linear</u> systems, which means

But the universe is generally <u>not</u> linear

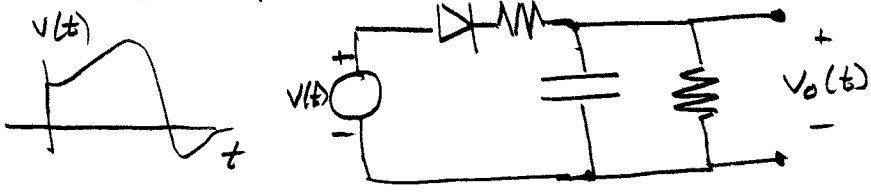
example



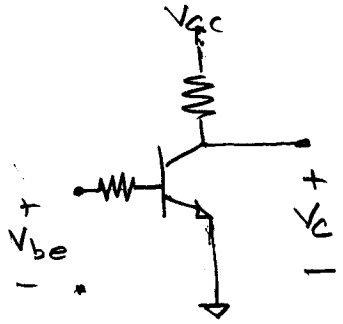

analyze this!

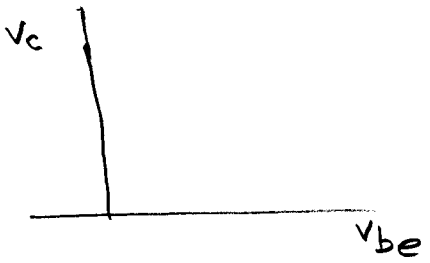
example



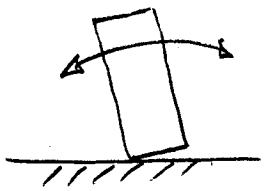

= ???

example

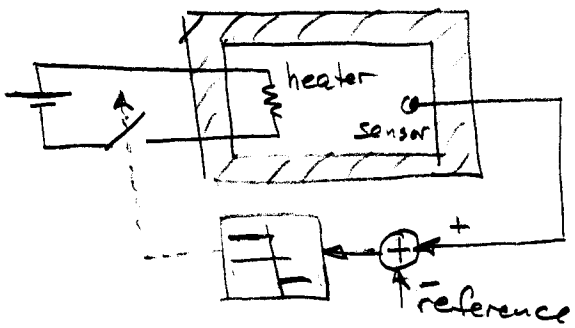



example



example




All these are interesting systems, yet none has a completely closed form solution; all are non linear. We need numerical solution by computer to get detailed response (although approximations give us a reasonable idea of behaviour)

- So why study linear systems?

Linear models are widely used in science and engineering because:

- their simple structure allows complete analytical solutions for behaviour
- which simplifies design
- they are a reasonable model for many almost-linear systems (though perhaps over a restricted range of values
- they capture dynamic effects (i.e. memory) with enough accuracy for many applications.