EE16B, Spring 2018
UC Berkeley EECS

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Lecture 5B: Open QA Session

Today: Open Q/A Session

- primarily on state space r. and beyond
  - circuits: Michel should be here at 3pm
- Why?
  - feedback on Piazza: many students seem lost
    - especially on state-space representations and beyond
  - **PLEASE SEE @309 on Piazza**
    - **https://piazza.com/class/jccq3d39dkzeu?cid=309**
    - **"Incredibly lost with the recent curriculum …"**

Steps to Help

- this Q/A session
- discussions next week will not move forward as originally planned
  - giving you a little time to catch up
- special discussion section ("LOST") each week?
  - logistics yet to be figured out
- each class from now on will have a "**LOST in class x**" Piazza page
  - for questions specific to that class
  - <u>please enter your questions ASAP (during class)</u>
- version of slides with animations will be put up
  - also, the handwritten notes during each class

Tips for Coping with This Class

- read through slides/notes BEFORE each class
  - identify (write down) tentative questions
    - if still unclear during/after class, ask (or on Piazza)
  - especially, try to figure out the flow
    - if you have flow questions, make sure to ask in class
- immediately after class (ideally)
  - put your questions in on the "LOST in lecture x" page
  - come to my office hours
  - re-read the material
    - **really strongly recommended**: re-write the material with your own hands (in your own writing) after each lecture
- **each lecture relies on understanding prior ones**
  - if you don't understand, you WILL lose it very quickly
    - (this is likely the current situation for state-space and beyond)

Per feedback on Piazza

- "you should know how to do this and ask for help if you can't at this point in the course"
  - prior to starting on 16B
    - basic EE: KVL, KCL, element equations
      - good facility at writing down the equations for simple circuits using the above (not just phasor form, but also using d/dt)
    - complex numbers and operations w them: really well!
      - conjugates; addition/multiplication; polar representation; Euler's (aka de Moivre's) formula; magnitude and phase
    - vector and matrix notation
      - including vector functions of vector arguments
    - the exponential function e^{at} and its general behaviour
    - matrix and linear algebra
      - matrix multiplication
      - rank (row rank, col. rank), determinants and inverses of square matrices
        - the minor formula for the determinant; how to invert a 2x2 matrix by hand (correctly!)
        - characteristic polynomials of square matrices

Per feedback on @309 (contd.)

- "you should know how to do this and ask for help if you can't at this point in the course"
  - prior to starting on 16B (contd.)
    - basic calculus
      - differentiation, integration, simple differential equations
      - functions of multiple variables, partial derivatives, total derivative
    - trigonometry
      - closely related to complex numbers (Euler/de Moivre Formula)
    - co-ordinate geometry
      - connection with simultaneous equations (linear and nonlinear)
      - graphical solution of equations
    - linearity: general definitions and concepts
      - being able to check if a system is linear or nonlinear
    - Taylor series
    - eigendecomposition (eigenvalues, eigenvectors)
      - eigenvalues as the roots of the char. poly.
    - no doubt missed some topics – please add

Per feedback on @309 (contd.)

- "you should know how to do this and ask for help if you can't at this point in the course"
  - introduced in my lectures (state-space onwards) so far:
    - simple RC and RLC examples: writing in state-space form
    - the pendulum example: writing the equations, then putting them in state space form
    - discrete time state space form, as illustrated by examples
    - concepts of inputs, outputs and state
      - as far as illustrated by the examples, at least
    - general state space form dx/dt (or x[t+1]) = f(x,u); y = g(x,u)
      - and how the pendulum, RLC, etc. can be cast in this form
      - which are linear, which are nonlinear
    - how to specialize the s.s.r to the DC/equilibrium case
      - how to solve the DC/eq. equation for simple scalar systems
      - including graphically – the concept of multiple DC op pts

Per feedback on Piazza (contd.)

- "you should know how to do this and ask for help if you can't at this point in the course"
  - introduced in my lectures so far (contd.):
    - ➔ how to apply Taylor series on the function f(.,.) to linearize a system around a DC op pt
      - both scalar and vector examples
        - the pendulum example – familiarity with and understanding of
          - regular and inverted pendulum DC op pts; linearizations about them
        - Jacobian matrices, their definition, w some practice working them out
    - ➔ stability (dynamical system stability)
      - basic intuitive concepts of stability
      - stability for scalar state space representations: Re(a) < 0
        - and why (the derivations)
      - stability for vector state space representations
        - using eigendecomposition to diagonalize/decompose into scalar systems
        - (familiarity w the derivations, too)