EE263 Autumn 2014–15 Sanjay Lall

# Lecture 20 Some parting thoughts . . .

- linear algebra
- levels of understanding
- what's next?

## Linear algebra

- comes up in many practical contexts (EE, ME, CE, AA, OR, Econ, . . . )
- nowadays is readily done
  cf. 10 yrs ago (when it was mostly talked about)
- Matlab or equiv for fooling around
- real codes (e.g., LAPACK) widely available
- current level of linear algebra technology:
  - 500 1000 vbles: easy with general purpose codes
  - much more possible with special structure, special codes (e.g., sparse, convolution, banded, . . . )

## Levels of understanding

#### Simple, intuitive view:

- 17 vbles, 17 eqns: usually has unique solution
- 80 vbles, 60 eqns: 20 extra degrees of freedom

#### Platonic view:

- singular, rank, range, nullspace, Jordan form, controllability
- everything is precise & unambiguous
- gives insight & deeper understanding
- sometimes misleading in practice

### **Quantitative view:**

- based on ideas like least-squares, SVD
- gives numerical measures for ideas like singularity, rank, etc.
- interpretation depends on (practical) context
- very useful in practice

- must have understanding at one level before moving to next
- never forget which level you are operating in

#### What's next?

- EE364a convex optimization I (Win 12-13)
- EE364b convex optimization II

(plus lots of other EE, CS, CME, MS&E, Stat, ME, AA courses on signal processing, control, graphics & vision, machine learning, computational geometry, numerical linear algebra, . . . )