

## 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. 20 yrs ago (when it was mostly *talked about*)
- ▶ Julia, Python, Matlab, etc. 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
- ▶ 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, ...)