

# SyDe114 Linear Algebra

Introduction

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This is not Powerpoint

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Introduction

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This is not Powerpoint

- I hate powerpoint

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## Introduction

- Stephen Birkett, Systems Design
  - physical systems: modelling and simulation
  - Motion Research Group (MoRG)
  - Piano Technology Lab
- E3-3158 (office) & 3160 (PTL)
  - 3rd floor of the new Mechatronics extension in E3
  - not easy to find first time!
  - above the SAE car area

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## Course webpage

- <http://real.uwaterloo.ca/~sbirkett>
  - contacts
  - course material/outline/info
  - regular updates
  - assignments & solutions
  - exam information
  - lecture slides in pdf form

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## Conventional [misguided] linear algebra course

- systems of linear equations
- matrices
- determinants
- vectors in  $\mathbb{R}^2$  and  $\mathbb{R}^3$
- Euclidean space  $\mathbb{R}^n$
- vector spaces
- inner product spaces
- eigenvalues and eigenvectors
- linear transformations

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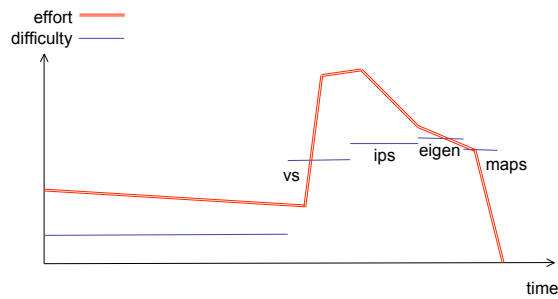
### The annotated version....

- systems of linear equations, matrices
  - repetition of school material for many [most]
  - complacency sets in
- determinants
  - school stuff for the most part
  - math content here is over-emphasized out of proportion with its future relevance in engineering
- Euclidean algebra ( $\mathbb{R}^2$ ,  $\mathbb{R}^3$  and  $\mathbb{R}^n$ )
  - important but still repetition and simple extension of school stuff
  - at this point you've had 6-7 weeks of rather easy, and for the most part quite familiar, material....

### Things begin to break down....

- vector spaces
  - a new fundamentally important topic hits about halfway through
  - a nasty surprise and leaves some behind almost immediately
- inner product spaces
  - another major (and important) new topic
  - for some inexplicable reason it is often only skimmed
- eigenvalues and eigenvectors
  - central to many engineering applications
  - by this point most students are in denial ['stupid mathie course']
- linear transformations
  - if stamina (and time) prevail, it is only briefly covered, or not at all
  - yet a key topic in engineering

### The traditional course map



### Shock and awe approach....

- I. Vector spaces
- II. Matrix algebra
- III. Linear maps
- IV. Eigenvalues & diagonalization
- V. Inner product spaces
- VI. Systems of linear equations

### Why?

- re-order and re-emphasize topics
- avoid complacency due to boredom and familiarity
- the more difficult concepts are spread more evenly
- central concept of vector space introduced up front
- easier concrete topics are directly connected to abstract concepts as examples
- stresses topics important for future applications in your core courses and technical electives
- easiest and most familiar topic comes at the end

### Sold?

- we'll see
- give me feedback (really) as we go along (really)
- suggestions are very useful, especially if there is some problem that can be addressed
- we can adapt on the fly if necessary...
- ...but perseverance is also necessary
- much of the benefit comes later when you have a solid background for core courses and technical electives
- SyDe114 (=Math114+Math115) often get short-changed or side-tracked

## New improved course map



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## Business stuff

- all business conducted on the course webpage (see slide 5)
- yahoo listserv for communication, announcements, discussions, griping etc
  - all should join
- selected assigned problems listed online
  - try them before looking at the solutions (also online)
- a non-programmable scientific calculator is useful [Zehrs type]
- 2.0 paid TAs
  - 15 hours per week
  - ... take advantage of that resource
- the text has ...
  - many worked examples...study them carefully
  - m a n y typos (beware)
- **GRADE = 10 time-limited homework test problems (4% each) + final exam (60%)**

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## Feedback

- I meant it
- I appreciate and listen to all feedback as we go along
- if something is a problem then tell me
- especially given that you guys are paying customers ....

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