

# Linear Algebra

Spring Semester 2013

Prof. Dr. Stefan M. Moser



## Syllabus

<http://moser.cm.nctu.edu.tw/nctu/la/>

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### 1 Website

There is a website which is always kept up-to-date:

<http://moser.cm.nctu.edu.tw/nctu/la/>

You will find there all necessary information and current announcements about this course. All handouts and exercises that are handed out during classes will also be available for download on this page. Note that while the website is available worldwide, most documents can only be downloaded from within the National Chiao Tung University (NCTU) and the National Tsing Hua University (NTHU).

### 2 Course Objective

This course is an introductory course in linear algebra. Its goal is to provide the students with a profound knowledge about linear algebra and some of its important applications. We will cover the following subjects:

- Vectors & matrices
- Solving linear equations:
  - Rows and columns of matrices
  - Elimination
  - Inverse matrices
  - Factorization
- Vector spaces:
  - The four subspaces: row space, column space, nullspace, left nullspace
  - Rank
  - Independence
  - Dimensions
  - The Fundamental Theorem of Linear Algebra
- Orthogonality:
  - Projections
  - Least squares

– Gram–Schmidt procedure

- Determinants
- Eigenvalues & eigenvectors
- Singular value decomposition
- Linear transformations
- Applications

For more detail see the above mentioned homepage.

We hope that a student who finishes the course will be able to better understand the principles of linear algebra, but also to appreciate its beauty: then in spite its incredible importance as a tool for every engineer, the linear algebra demonstrates mathematical elegance and power at its best.

### 3 Prerequisites

The following lectures/topics are recommended:

- Basic math from high-school

### 4 Instructor

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### 5 Time and Place

There will be two lectures per week:

- Tuesday, 10:10–12:00 (CD), Engineering Building IV, Room B26 (ED026)
- Thursday, 15:30–16:20 (G), Engineering Building IV, Room B26 (ED026)

The course starts on Tuesday, 19 February 2013, and finishes on Thursday, 20 June 2013. For a more detailed program see the above mentioned website.

### 6 Office Hours

NCTU requests that every teacher offers two hours per week where students may come to ask questions. The exact time will be announced once it is decided.

However, we would like to encourage you to show up in the teacher's or teaching assistant's office at any time in case you have questions about the class or related subjects. Moreover, we are always available during and after classes.

## 7 Textbook

The course will be based on

- Gilbert Strang: *Introduction to Linear Algebra*, Wellesley-Cambridge Press, Massachusetts, USA, fourth edition, 2009. ISBN: 978-0-9802327-2-1.

For certain topics there might be some additional handouts. Note that at

<http://ocw.mit.edu/courses/mathematics/18-06-linear-algebra-spring-2010/video-lectures/>

one can find video lectures of Prof. Strang teaching linear algebra based on his textbook.

## 8 Exercises

Every week, an exercise will be distributed in class and also made available online for download. This exercise will consist of several problems that need to be solved at home and handed in during the class of the following week. A model solution will be handed out and made available online afterwards.

We believe the exercises to be extremely important and crucial to the understanding of the course. They also serve as a preparation for the mid-term and final exams and we therefore highly recommend to solve them. **To pass the course you need to hand in at least 10 exercises.**

## 9 Exams

There will be one mid-term and one final exam. The final exam is going to last three hours. Both exams will be open-book. Details about the covered material in the mid-term exam will be published in due time. The final exam will cover everything taught in class.

## 10 Grading

The grade will be an average of

- the homework and class participation (15%),
- the mid-term exam (35%), and
- the final exam (50%).

The grade of the homework will not be based on the correctness of the answers, but rather on the effort the student shows in trying to solve them. Moreover, I will try to reward students who participate actively in class. This course is worth 3 credits.

## 11 Special Remarks

The lecture will be held in English.