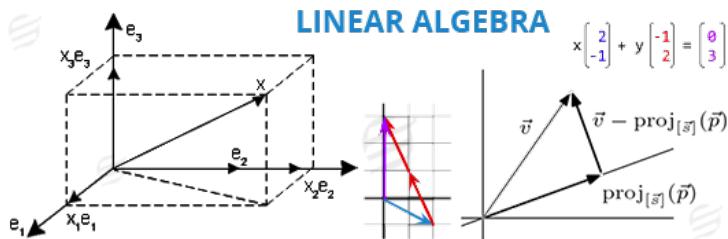


欢迎大家来到清华



线性代数（理科类）

颜文斌

2019年秋季学期

关于教师：颜文斌



清华三字班 (2003)



2007-2012: 纽约州立
大学石溪分校，物理
学博士



2017年回母校任教

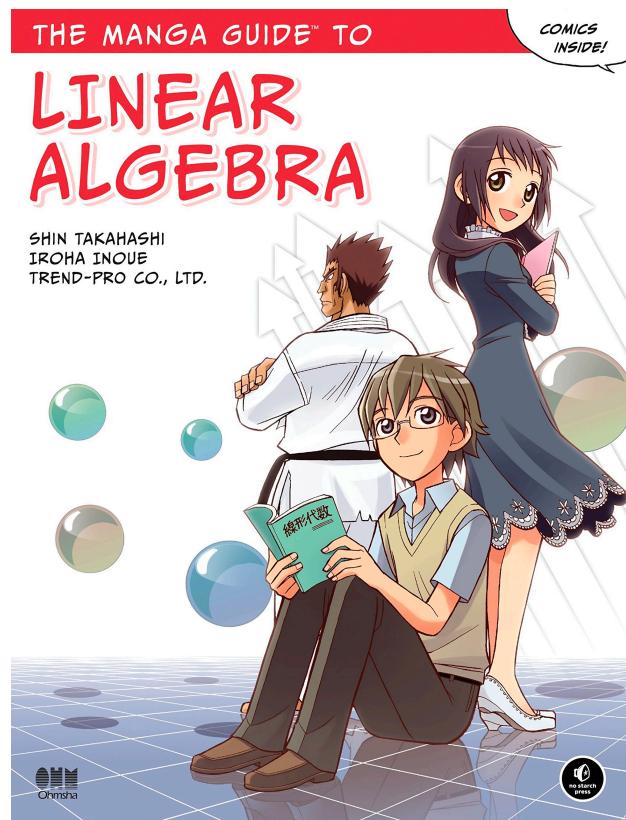


专业方向：理论物理

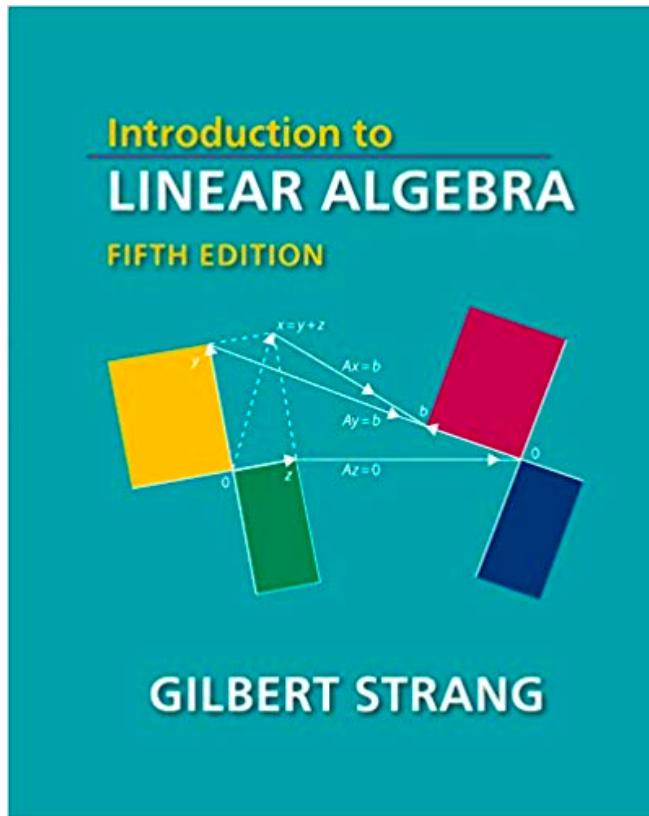
个人主页：<https://ymsc-strings.github.io/people/wenbin.html>

关于教材

梦想：



现实：



关于教材

- ▶ Gilbert Strang, Introduction to linear algebra (5th edition)
- ▶ 优点：内容编排优秀、文字浅显易懂、应用较多、排版重
点突出、英文
- ▶ 缺点：价格较贵、英文
- ▶ 提供中英文专有名词对照表

3.1 Spaces of Vectors

- 1 The standard n -dimensional space \mathbf{R}^n contains all real column vectors with n components.
- 2 If v and w are in a vector space S , every combination $c v + d w$ must be in S .
- 3 The “vectors” in S can be matrices or functions of x . The 1-point space Z consists of $x = 0$.
- 4 A subspace of \mathbf{R}^n is a vector space inside \mathbf{R}^n . Example: The line $y = 3x$ inside \mathbf{R}^2 .
- 5 The column space of A contains all combinations of the columns of A : a subspace of \mathbf{R}^m .
- 6 The column space contains all the vectors Ax . So $Ax = b$ is solvable when b is in $C(A)$.

To a newcomer, matrix calculations involve a lot of numbers. To you, they involve vectors. The columns of Ax and AB are linear combinations of n vectors—the columns of A . This chapter moves from numbers and vectors to a third level of understanding (the highest level). Instead of individual columns, we look at “spaces” of vectors. Without seeing *vector spaces* and especially their *subspaces*, you haven’t understood everything about $Ax = b$.

Since this chapter goes a little deeper, it may seem a little harder. That is natural. We are looking inside the calculations, to find the mathematics. The author’s job is to make it clear. The chapter ends with the “Fundamental Theorem of Linear Algebra”.

We begin with the most important vector spaces. They are denoted by \mathbf{R}^1 , \mathbf{R}^2 , \mathbf{R}^3 , \mathbf{R}^4, \dots . Each space \mathbf{R}^n consists of a whole collection of vectors. \mathbf{R}^5 contains all column vectors with five components. This is called “5-dimensional space”.

DEFINITION The space \mathbf{R}^n consists of all column vectors v with n components.

The next section creates a vector space $N(A)$, to describe all the solutions of $Ax = 0$. This section created the column space $C(A)$, to describe all the attainable right sides b .

■ REVIEW OF THE KEY IDEAS ■

1. \mathbf{R}^n contains all column vectors with n real components.
2. \mathbf{M} (2 by 2 matrices) and \mathbf{F} (functions) and \mathbf{Z} (zero vector alone) are vector spaces.
3. A subspace containing v and w must contain all their combinations $c v + d w$.
4. The combinations of the columns of A form the *column space* $C(A)$. Then the column space is “spanned” by the columns.
5. $Ax = b$ has a solution exactly when b is in the column space of A .

$C(A) = \text{all combinations of the columns} = \text{all vectors } Ax$.

教材、参考书

- ▶ *Introduction to Linear Algebra*, Wellesley-Cambridge Press, 2016年6月10日, 第五版, Gilbert Strang, 麻省理工学院
- ▶ 大学数学(代数与几何), 高等教育出版社, 2006年5月, 第二版, 萧树铁, 居余马, 李海中, 清华大学
- ▶ 课程主要参照第一本教材。
- ▶ 课件中的一些例子直接取自教材和参考书

课程相关

- ▶ 教学进度、作业、考试同谢丹老师的课程**一致**
- ▶ 课件：网络学堂、个人主页
- ▶ 考核方式：平时（作业、随堂测验）20%，期中20%，期末60%
- ▶ 作业：每周一交上一周作业，方式由助教决定
 - ▶ 要求：按时交作业，**不得抄袭**（可以讨论，要注明）
- ▶ 答疑：
 - ▶ 每周固定时间：周四晚上19:00-21:00，静斋218
 - ▶ 微信群
- ▶ 课堂：手机静音、不迟到、有问题随时提问

教学计划：前半学期

- ▶ 第一章 向量：9.9
- ▶ 第二章 线性方程组：9.12, 9.16, 9.19
- ▶ 第三章 线性空间：9.23, 9.26, 9.30
- ▶ 第四章 正交性：10.10, 10.14
- ▶ 第五章 行列式：10.17, 10.21
- ▶ 期中复习：10.24
- ▶ 期中考试：10.28

教学计划：后半学期

- ▶ 第六章 特征值和特征向量：10.31, 11.4, 11.7
- ▶ 第七章 奇异值分解：11.11, 11.14, 11.18
- ▶ 群、环、域简介，一般线性空间：11.21, 11.25
- ▶ 第八章 线性变换：11.28, 12.2
- ▶ 第九章 复向量和复矩阵：12.5, 12.9
- ▶ 计算机和线性代数：12.12
- ▶ 第十章 线性代数的应用：12.16, 12.19, 12.23
- ▶ 期末复习：12.26

注：教学计划供参考，会根据实际情况调整，并且跟谢丹老师课程保持同步。