

Beijing Institute of Technology - School of Mathematics and Statistics - 2018-19

Matrix Analysis

Note: this syllabus is still subject to changes. These changes will be expressed clearly during class.

Instructor: Jean-Luc Bouchot, Liangxiang Campus, Room 405, jlbouchot@bit.edu.cn

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Hours: The class meets once a week: Sunday-8:00-11:30 (break from 9:35 to 9:50) in The graduate building, room 502.

Office hours: Sunday, 1pm-2pm, Zhonguangcun Campus, Central Teaching Building, Room 846. **Tutoring:** Friday 4pm-5pm, Zhonguangcun Campus, room TBD

Ressource: <https://github.com/jlbouchot/Classes/tree/master/MatrixAnalysis>.

Textbook: *Matrix analysis*, Horn and Johnson. Cambridge University Press

Note however that any textbook may work for your own study. Homeworks will be taken mainly from the textbook. Compulsory graded assignments will be given as a pdf file.

Description: Matrix analysis is usually the second course in linear algebra and definitely a more advanced one. It introduces important topics used in many areas of engineering, applied mathematics, statistics, computing, ... Understanding the concepts and ideas will simplify many other courses.

Course format: The class meets once a week in a lecture format. However in-class exercises will be given for you to practice directly your understanding of the presented topics. Moreover, suggested homeworks, which may or may not be corrected in class, will be provided on a weekly basis. These exercises will not be graded individually.

Grading policy: Grading will be done through **two compulsory homework assignments** and **one final exam**. Here is the tentative point distribution:

- 40% for the compulsory assignments (20 each). They will be assigned at the end of weeks 3 and 6 and should be turned in a week later. You are allowed to think and work the

problems in groups, **but the work your turn in should be done alone.**

- 60% for the final. It will last two hours and will be given during final week.

Objectives: By the end of the term, the students are expected (among others)

- to understand how norms work in different Hilbert spaces,
- to know about certain matrix factorizations and their potential applications,
- to estimate eigenvalues of matrices.

Attendance: will not be recorded, but keep in mind that many things will not be available outside the classroom. You are responsible for whatever is being said in class and questions will not be answered if already answered in class. Note that this class is dense and covers a lot of topics. Missing a class may drastically lower your final grade. Active participation in class (both asking questions and working out the in-class exercises) will also help your understanding of the materials.

While it is okay to mail or ask question outside class, these shall stay unanswered if they have already been answered in class. All correspondence should be addressed with the [MtxAn.] tag in the subject. Failing to follow these conditions will impact your grade negatively. No homework/exam/project will be accepted later than the due date. Some arrangement might be possible if and only if the students advise before the due date and because of a valid reason (medical, religious).

Tentative schedule: The class will be organised as follows (this is subject to change according to the audience). The book chapters are just given as reference, but materials from other sections of the book may be used.

Week	Class date	Class topic	Book ref.	Remarks
1	2018/11/18	Review of linear algebra	0	
2	2018/11/25	Inner product and Hilbert spaces	0	
3	2018/12/2	Schur's factorization	2.3, 2.4	Assignment 1 out
4	2018/12/09	Spectral theorems	2.5	Assignment 1 due
5	2018/12/16	QR Factorization	2.1-2.2	
6	2018/12/23	Jordan canonical form	3.1	Assignment 2 out
7	2018/12/30	Courant-Fisher theorem	4.1,4.2	Assignment 2 due
8	2018/01/06	Geršgorin's disc theorem	6.1	