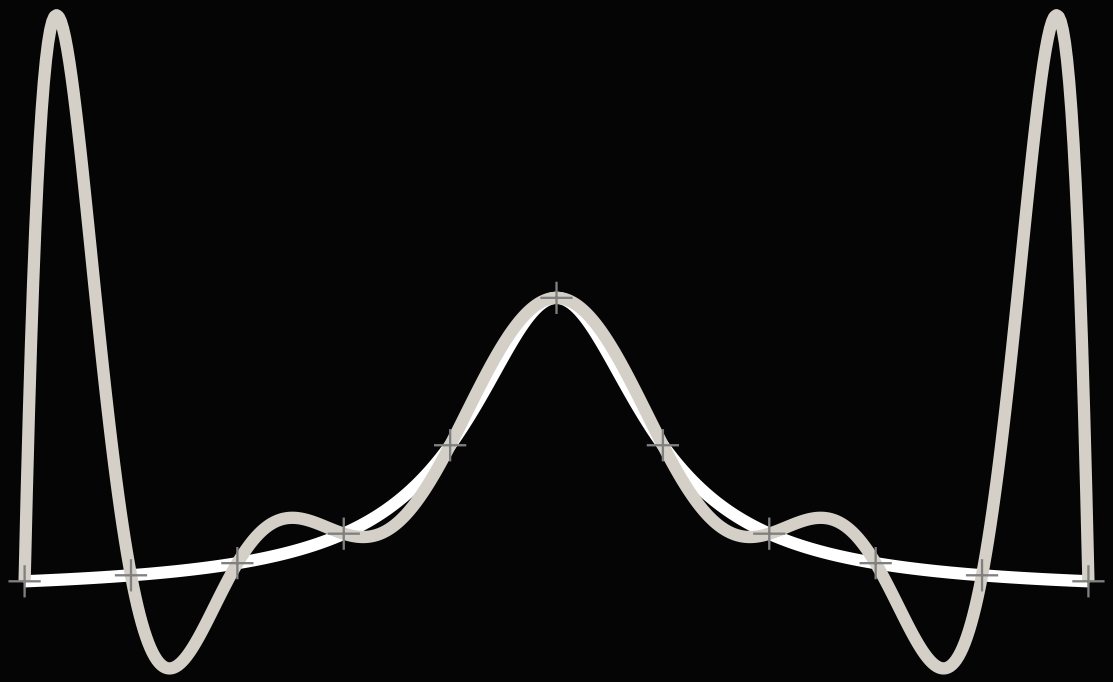
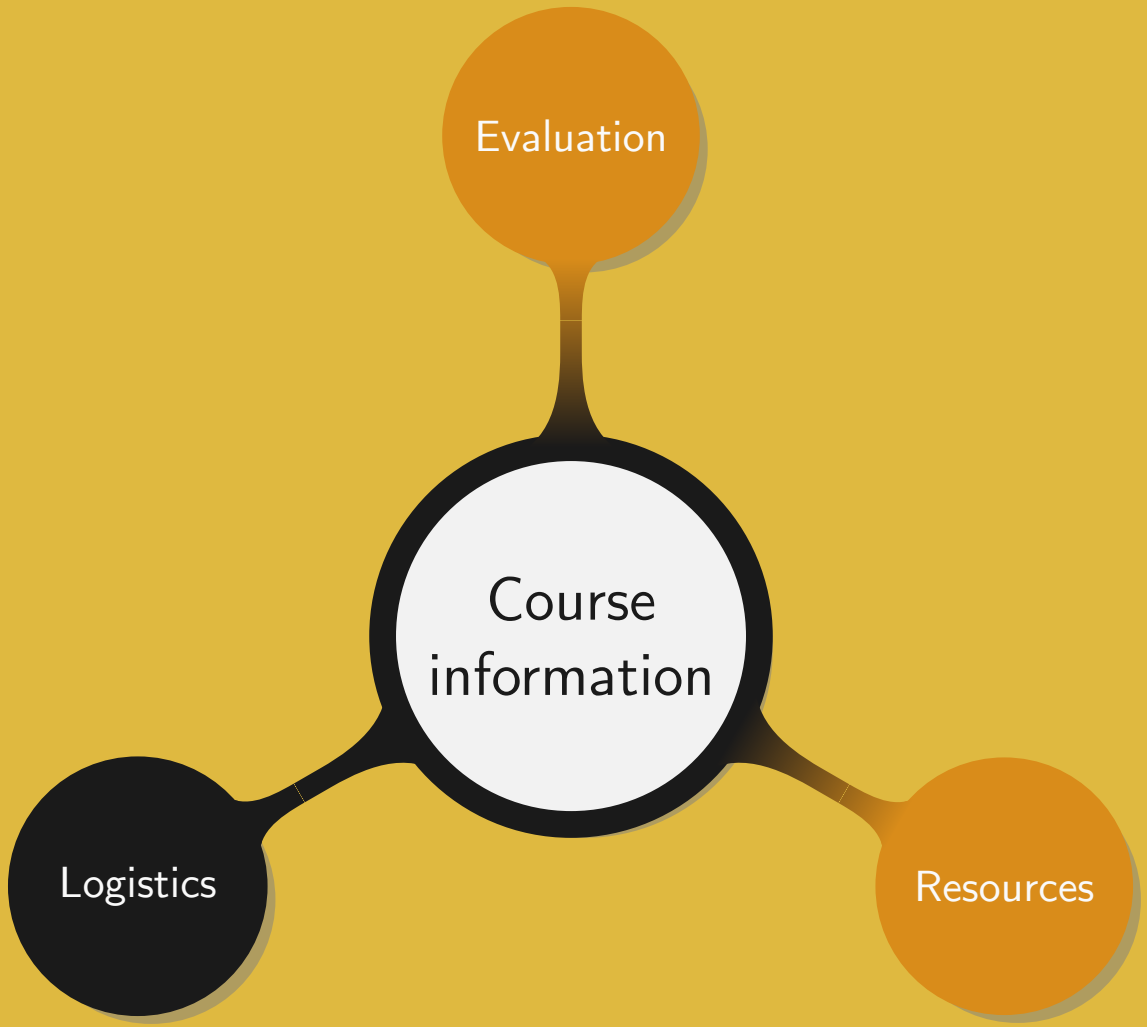


Introduction to Numerical Methods

0. Course information

Ailin & Manuel – Fall 2025

Chapter organisation



Basic information

Teaching team:

- Instructors:
  - Ailin (ailin.zhang@sjtu.edu.cn)
  - Manuel (charlem@sjtu.edu.cn)
- Teaching assistant: Zhiyuan (zhiyuan_wang@sjtu.edu.cn)

Course arrangements:

- Lectures:
  - Monday 14:00 – 15:40
  - Wednesday 14:00 – 15:40
- Refer to Canvas homepage for office hours times

Communication rules

To ensure smooth communication:

- Carefully comply with the course communication policies
- Prepend [MATH471] to the email subject, e.g. `[MATH471] h2 grade issue`
- When contacting a TA for an important matter, `CC` the instructor
- Use SJTU NetDisk service to share large files (> 2 MB)
- Ensure Canvas email address is set to your SJTU address
- Check Canvas and SJTU emails at least once a day

- Never change your Canvas email address
- Never send large files by email
- Never post screenshots

Course objectives

This course splits into two parts:

- Numerical Analysis
  - Become familiar with the rigorous analysis of most common methods
  - Get solid mathematical foundations to tackle harder problems
- Numerical Methods
  - Understand how to apply numerical methods to solve problems
  - Be able to connect numerical analysis to numerical methods

Construct and assess the quality of methods to solve a given problem

Course workflow

Learning strategy:

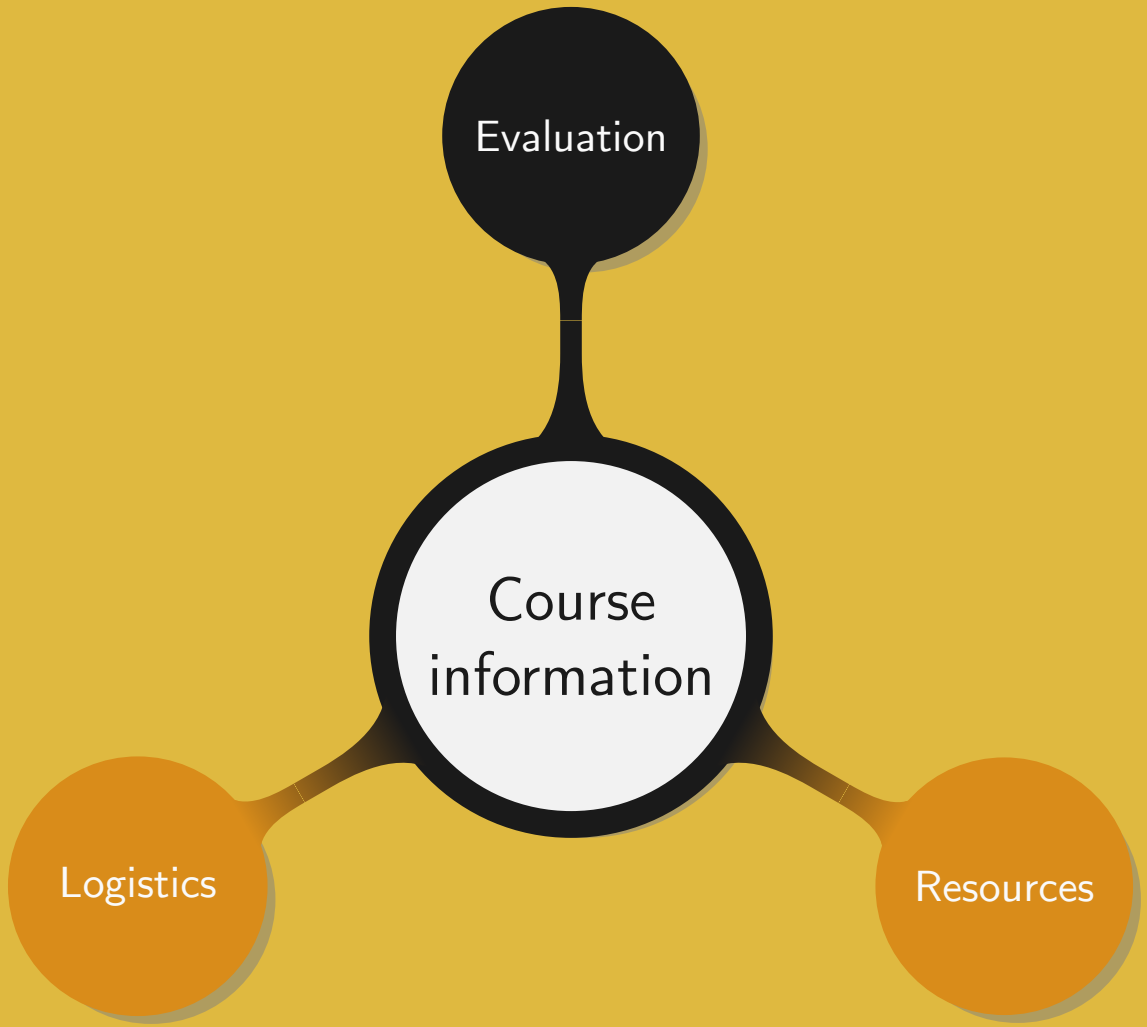
- Course side:
  1. Understand the basic concept of numerical analysis
  2. Know the most common problems and their solutions
  3. Get an overview of the wide applications of numerical methods
- Personal side:
  1. Prove mathematical results
  2. Derive clean and clear algorithms from mathematical results
  3. Relate known strategies to new problems
  4. Perform extra research

Course outcomes

Detailed goals:

- Understand the mathematics behind numerical analysis
- Be proficient at using all the basic numerical methods
- Be able to assess the quality of a method
- Know how to perform function interpolation
- Know the common methods for numerical integration
- Solve various nonlinear equations numerically
- Solve various nonlinear optimisation problems numerically
- Solve systems of linear equations numerically
- Solve eigenvalue problems numerically
- Find various matrix decomposition numerically
- Solve various ordinary differential equations numerically

Chapter organisation



Assignments

Homework:

- Total: $6 + 4$
- Content: basic concepts, prove results, derive algorithms

Projects:

- Total: 1
- Content: neural networks, theory and applications

Grading policy

Grade weighting:

- Projects: 25%
- Homework: 20%
- Midterm exam: 27.5%
- Final exam: 27.5%

Assignment submissions:

- Bonus: $+10\%$ for a work fully written in LaTeX, limited to 100%
- Penalty: -10% for a work not written in a neat and legible fashion
- Late policy: -10% per day, not accepted after three days

Grades will be curved with the median in the range $[\![B, B+]\!]$

Honor Code

General rules:

- Not allowed:
  - Reuse the work from other students
  - Reuse the work from the internet
  - Give too many details on how to solve an exercise
- Allowed:
  - Share ideas and understandings on the course
  - Provide general directions on where or how to find information

Shared details should never solve a question

Honor Code

Documents allowed during the exams: an A4 paper sheet with original handwritten notes

Default Honor Code policy for group works:

- Every student in a group is responsible for his group submission
- In case of violation, the whole group is sent to Honor Council

Default Honor Code policy for generative AI: not allowed

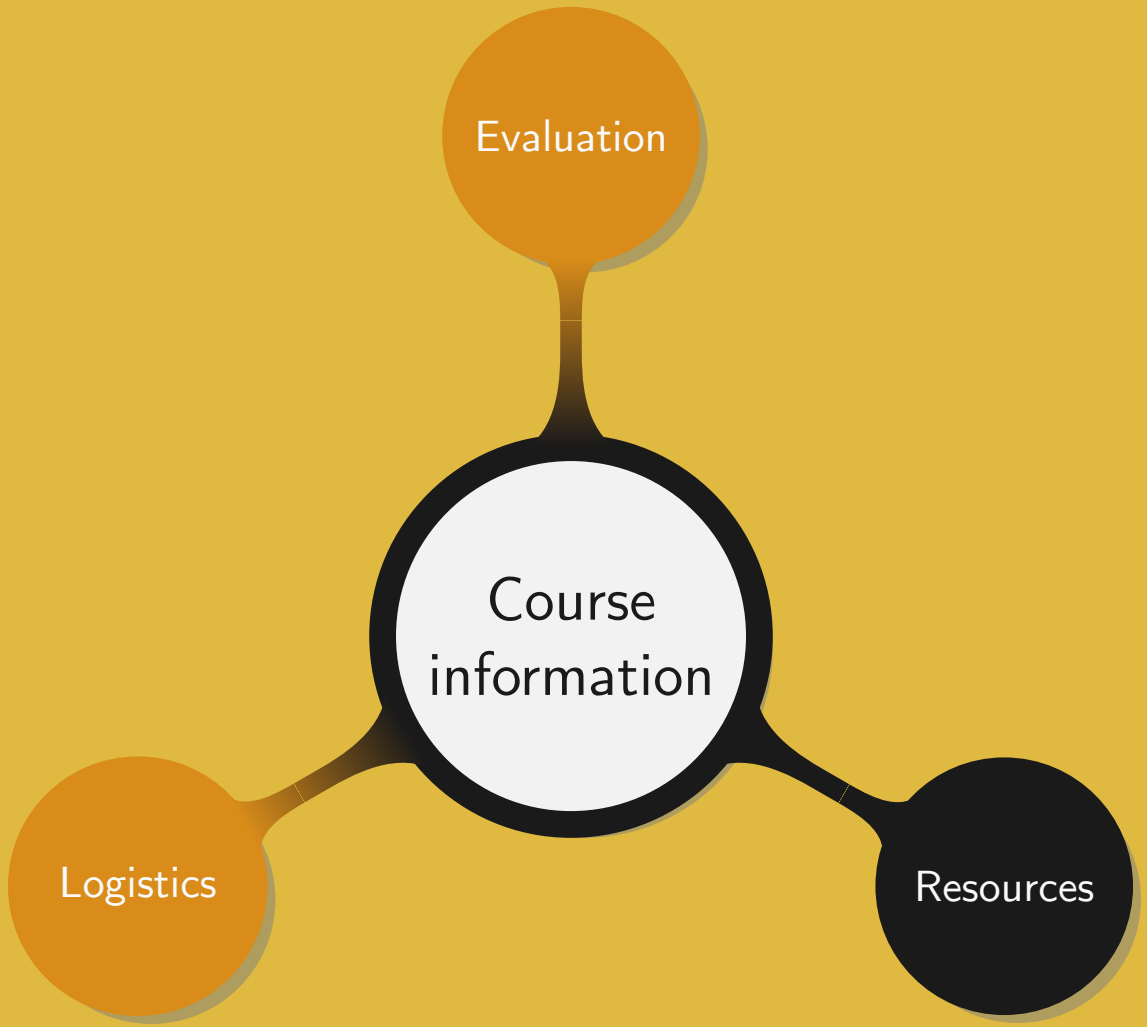
Special circumstances

Contact us as early as possible when:

- Facing special circumstances, e.g. full time work, illness
- Feeling late in the course
- Feeling to work hard without any result

Any late request will be rejected

Chapter organisation



Course resources

Canvas:

- Syllabus
- Lecture slides
- Homework
- Projects
- Announcements
- Grades
- Surveys

Gitea:

- Extra documents
- Course support

Mattermost:

- Announcements
- Quick questions

References

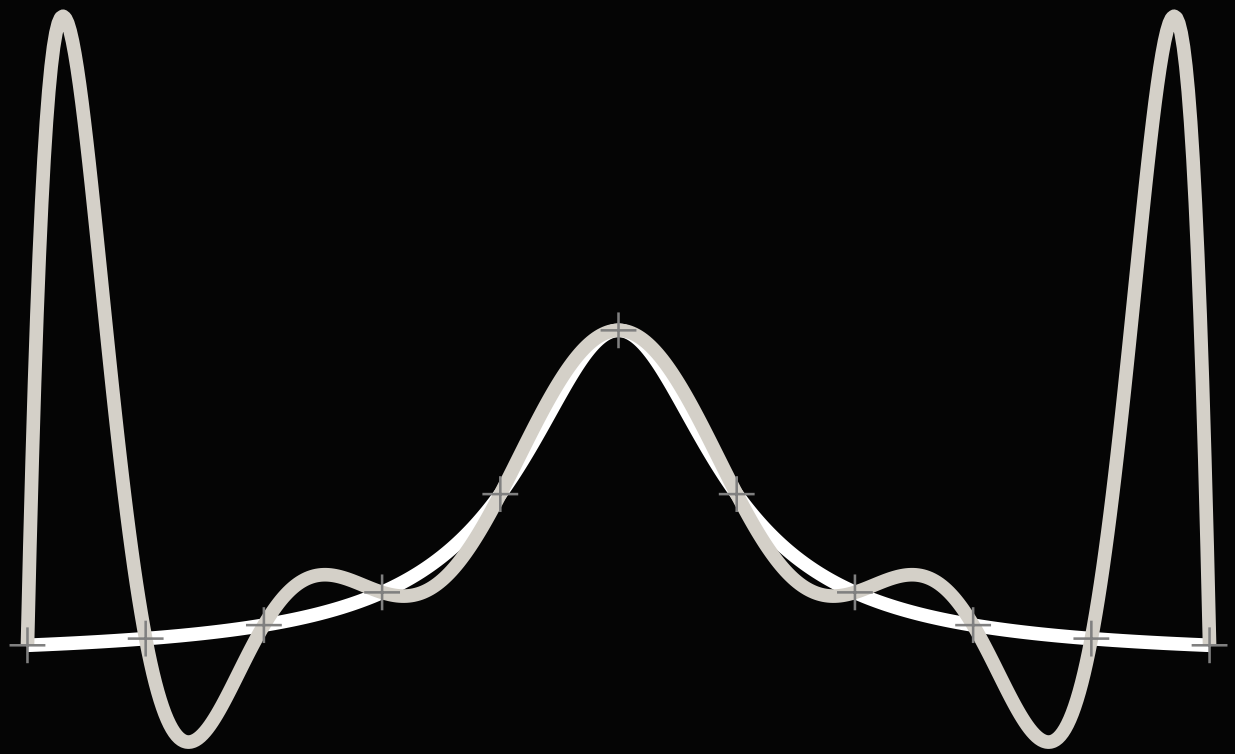
The course is self-contained, do not abuse external resources

Useful places where to find information:

- *Fundamentals of Engineering Numerical Analysis*, Moin
- *Introduction to Algorithms*, Cormen, Leiserson, Rivest, and Stein
- *Numerical Methods using MATLAB*, Mathews, and Fink
- *Numerical Recipes*, Press, Teukolsky, Vetterling, and Flannery
- Search information online, i.e. $\{websites \setminus \{non\text{-}English\ websites\}\}$

Key points

- Work regularly, do not wait the last minute
- Respect the Honor Code
- Go beyond what is taught
- Do not learn, understand
- Keep in touch with us
- Feedback and suggestions are always much appreciated



Thank you!