Math 6008: Numerical Methods for PDEs - Spring 2022

Instructor

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Textbook

- 路金甫,关治. 偏微分方程数值解法(第3版). 清华大学出版社

Other references

- R. LeVeque, Finite Difference Methods for Ordinary and Partial Differential Equations, SIAM 2007.
- C. Johnson, Numerical Solution of Partial Differential Equations by the Finite Element Method, Dover 2009

You do not have to buy the books, as there will be lecture notes. We will mainly refer to the book by "路金甫,关治" but some materials will be from other references like the one by Leveque.

Grading Policy

Cheating is not allowed. You can discuss of course, but you should write your own solutions. If identical assignments are found, both will get zero credits.

- *Homework (45%).* Homework will be assigned every two weeks. If coding is needed, you can use whatever language you prefer (like C++, Python, MATLAB). Please indicate your designed algorithms in the homework and show your results via figures or tables. The actual code should be submitted as appendices only.
- *Quiz (20%)* Through the semester, there will be 4-6 quizzes. In each quiz, you will be asked to solve a problem in 10∼15 minutes in class. I will tell you in advance what topic will be covered in the quiz.
- *Project (35%).* You can choose a problem related to solving partial differential equations numerically. It is fine if your project is purely numerical analysis. However, quite often, you may want to find a concrete problem or equation, then you design numerical schemes and do numerical experiments. More details will come later.

Tentative Schedule:
There will be 15 lectures.

- **Week 1-3**: Itroduction, basic concepts like consistency, stability and some standard analysis techniques in numerical PDEs.
- **Week 4-6** Numerical methods for solving elliptic equations.
- **Week 7-12**: Numerical methods for solving evolutionary equations (including the hyperbolic and parabolic equations). Know how to do analysis for the numerical methods.
- **Remaining time**: Brief introduction to variational principles and finite element methods. If time allows, will touch the spectral methods briefly as well.