CSC446H1/CSC2310H: Computational Methods for Partial Differential Equations, Fall 2021
University of Toronto
Syllabus

Lectures: Mondays 12pm–2pm, Wednesdays 12pm-1pm

Instructor: Kirill Serkh
Email: kserkh@math.toronto.edu
Office Hours: Wednesdays, 1pm-2pm

Grading: 75% homework, 25% final project

Textbook: *Difference Methods for Initial Value Problems*, 2nd ed., by R.D. Richtmyer and K.W. Morton

Course contents:

1.   Classification of partial differential equations, and their properties
2.   Finite differences, truncation and cancellation errors
3.   Order of convergence
4.   Stability and instability, Explicit and implicit difference equations
5.   Lax theorem on the equivalence of stability and convergence
6.   Variable coefficients and nonlinearity
7.   Different types of boundary conditions, and their effect of stability
8.   Non-uniform grids and non-rectangular domains
9.   Solvers for sparse linear systems, Direct methods, Iterative methods
10.   Preconditioning
11.   The multigrid method
12.   Method of characteristics
13.   Finite element methods
14.   Method of fundamental solutions
15.   Boundary integral equation methods, Boundary element methods

Assignments:

There will be 5 homework assignments, each worth 15% of your grade, with the due dates Sept. 29, Oct. 13, Nov. 3, Nov. 24, and Dec. 8. The homeworks will involve a combination of mathematics and programming.

Final project:

For the final project, you will have the option of choosing between a project that I will assign, or proposing your own. If you would like to choose your own project, please discuss it with me to make sure that it is suitable. It must be submitted by Dec. 21.

Academic integrity:

The following helpful webpage answers many questions on this topic:
https://www.academicintegrity.utoronto.ca/perils-and-pitfalls/.

Accessibility:

If you have any accessibility-related concerns, please let me know. More information can be found
here: https://studentlife.utoronto.ca/department/accessibility-services/.

Student resources:

The academic calendar is available here: https://fas.calendar.utoronto.ca/sessional-dates. Some general
information about the 2021-2022 academic year, including COVID-19 planning, is available here:
https://www.utoronto.ca/utogether. The Health and Wellness Centre offers mental health services to
students; to get more information, visit their website here:
https://studentlife.utoronto.ca/service/mental-health-care/.

Absence declarations:

For 2021-22, the Verification of Illness (or "doctor's note") is not required. Students who are absent
from academic participation for any reason (e.g., COVID, cold, flu and other illness or injury, family
situation) and who require consideration for missed academic work have been asked to record their
absence through the ACORN online absence declaration.

September 9-23:

The course will be held virtually over Zoom during this period.