MATH 4050/4060/6182 - Topics in Mathematics II
Winter 2020
Numerical Solutions of Differential Equations

Class Schedule and Location: MWF 11:30-12:20 in MCKN 227

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Office Location: MACN 512
Office Hours: Mon. & Wed. 13:30-15:00 or by appointment

Content:

We will study the two main classes of numerical techniques for computing a solution to an Initial Value Problem (a system of Ordinary Differential Equations with an initial condition): Runge-Kutta Methods, and Linear Multi-Step Methods. We will define notions of accuracy and stability and see how these two principles determine the behaviour of these methods. In addition we will consider numerical methods for Boundary Value Problems (a system of Ordinary Differential Equations with conditions at two end points) and will introduce Finite Difference methods for Partial Differential Equations. The course will involve some computer programming, using MATLAB or the language of your choice, although extensive prior programming experience is not necessary.

Relevant Texts:

- Chapter 1 and parts of Chapter 3 of "Finite Difference and Spectral Methods for Ordinary and Partial Differential Equations", L.N. Trefethen, 1996, free on-line text, http://people.maths.ox.ac.uk/trefethen/pdetext.html
- "Numerical Analysis", T. Sauer, Pearson, 2006 (2nd ed. 2012).
- "Numerical Analysis", 8th ed., R.L. Burden, D.J. Faires, 2005 (10th ed. 2016).
- "Numerical Methods for Ordinary Differential Equations", J.C. Butcher, Wiley, 2008.

The first text is available at the given web address. The next two texts are on reserve in the library. They will be used primarily for the Boundary Value Problem material. The last text is a high level text on Runge-Kutta methods and is available as an e-book through the library.

Evaluation:

There will be four assignments throughout the semester, due dates: 29 Jan., 24 Feb., 13 Mar., 1 Apr. Each assignment will be worth 17.5%. Those enrolled in MATH*6182 will have additional questions on each of the assignments.

The final exam is at 19:00 on Friday, April 17; it will be worth 30%.

For the assignments you may consult with one another or with me, but the exchange of information in such consultations should be general, such as "*How do you do number 2?*" "*By showing that all roots of the polynomial have magnitude less than one.*" Copying of solutions is not acceptable.

Programming:

The assignments and final exam will all include some programming component. You may use whatever language you prefer, but, if you are not very familiar with programming languages, then I suggest you use MATLAB. It is fairly easy to learn and we will be using it in class to some degree.

University Policies

E-mail Communication

All students are required to check their University of Guelph e-mail account regularly; e-mail is the official route of communication between the University and its students.

Academic Accommodation of Religious Obligations

If you are unable to complete a course requirement due to religious obligations, please let the instructor know within the first two weeks of class. See the academic calendar for more information:
http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-accomrelig.shtml

Academic Consideration

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons, please advise the course instructor in writing, with your name, id, and e-mail contact. See the academic calendar for information on regulations and procedures for Academic Consideration:
http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml

Academic Misconduct

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community, faculty, staff, and students to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection. Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor. The Academic Misconduct Policy is detailed in the Undergraduate Calendar:
http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml

Accessibility

The University of Guelph is committed to creating a barrier-free environment. Providing services for students is a shared responsibility among students, faculty and administrators. This relationship is based on respect of individual rights, the dignity of the individual and the University community's shared commitment to an open and supportive learning environment. Students requiring service or accommodation, whether due to an identified, ongoing disability or a short-term disability should contact the Student Accessibilities Services (SAS) as soon as possible. For more information, contact SAS at 519-824-4120 ext. 56208 or email csd@uoguelph.ca or see the website: http://www.uoguelph.ca/csd/

Drop date

The last date to drop one-semester courses, without academic penalty, is the last day of classes. See the Undergraduate Calendar Schedule of Dates:
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c03/index.shtml
For regulations and procedures for Dropping Courses, see the Academic Calendar:
http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml

Recording of Materials

Presentations which are made in relation to course work, including lectures, cannot be recorded in any electronic media without the permission of the presenter, whether the instructor, a student, or guest lecturer. When recordings are permitted they are solely for the use of the authorized student and may not be reproduced, or transmitted to others, without the express written consent of the presenter.