JOINT INSTITUTE
交大密西根学院

Course Syllabus

Vv 256: Honors Calculus IV

Course Description

The course gives a detailed introduction to the theory of ordinary differential equations (ODEs) and also demonstrates elementary approaches in calculus of variations and theory of partial differential equations (if time allows). Despite the course focuses on applications of differential equations in analysis of physical, chemical, biological phenomena, it introduces the fundamental approach to the qualitative theory of ODEs as well. Students will work with different textbooks and related scientific papers.

In the first part of the course, basic modelling techniques using ODEs/systems of ODEs as well as a good number of methods to solve the related problems are defined. The questions of stability/Lyapunov stability are discussed.

In the second part of the course, the methods of series solutions, Lyapunov and Fourier transformations are introduced. Applications of the methods to ODE and PDE problems are studies.

Instructor

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Textbooks

1. Pontryagin L.S. Differential Equations. Addison-Wesley publishing company.
2. George F. Simmons. Di_erential equations with applications and historical notes, third edition, CRC Press, 2017.
3. William E.Boyce, Richard C.DiPrima, Douglas B. Meade. Elementary Differential Equations and Boundary Value Problems, 11th edition, Wiley, 2017.
4. Kam Tim Chau. Theory of differential equations in engineering and mechanics, CRC Press, 2017.
5. Yuefan Deng. Lectures, problems and solutions for ordinary differential equations, second addition, World Scientific, 2018.
6. Marcelo Epstein. Partial differential equations. Mathematical techniques for engineers, Springer, 2017.

Grading Policy

Assignments/Projects **20%**

Exams **80%**: Midterm Exam I-**25%**, Midterm Exam II-**25%**, Final Exam -**30%**

Honor Code Policy

Honesty and trust are important. Students are responsible for familiarizing themselves with what is considered as a violation of honour code. Assignments/projects are to be solved by each student individually. Students are encouraged to discuss problems with other students, but students are advised not to show your written work to others. Copying someone else's work is a very serious violation of the honour code. Students may read resources on the Internet, such as articles on Wikipedia, Wolfram MathWorld or any other forums, but they are not allowed to post the original assignment question online and ask for answers. It is regarded as a violation of the honour code. Since it is impossible to list all conceivable instance of honour code violations, students have the responsibility to always act in a professional manner and to seek clarification from appropriate sources if their or another students conduct is suspected to be in conflict with the intended spirit of the honour code.

Teaching Schedule

Week	NO.	Date	Lectures and Exams	Comments
1	1	2019-09-10	Introduction	§1, 2.3
	2	2019-09-12	Separable and linear ODEs	§2.1-2.2
		2019-09-13	*National Holiday*	
2	3	2019-09-17	Other types of first-order ODEs	Lecture slides
	4	2019-09-19	Autonomous ODEs	§2.5
	5	2019-09-20	Intervals of existence	§2.8
3	6	2019-09-24	Implicit first-order ODEs. Singular solutions.	Lecture slides
	7	2019-09-26	Introduction to linear spaces and elements of linear algebra	Lecture slides §7.2-7.3
	8	2019-09-27	Normal systems of ODEs. Existence and uniqueness theorem. Properties of solutions.	Lecture slides §7.4
4		*2019-10-01*	*National holidays*	
		2019-10-03	*National holidays*	
		2019-10-04	*National holidays*	

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5	9	2019-10-08	Complex ODEs. Higher order ODEs with variable coefficients.	Lecture slides
	10	2019-10-10	Higher order ODEs with constant coefficients.	§3.1-3.4
	11	2019-10-11	Nonhomogeneous higher-order linear ODEs. Euler equation.	§3.5-3.6, §4
6	12	2019-10-15	Free/forced mechanical oscillations, electrical vibrations.	§3.7-3.8
	13	2019-10-17	**Midterm Exam I**	
7	14	2019-10-22	Linear systems of ODEs with constant coefficients.	§7.4-7.5
	15	2019-10-24	Fundamental matrices.	§7.7-7.9
8	16	2018-10-29	Phase planes and stability.	§9.1-9.3
	17	2018-10-31	Applications of systems of linear differential equations in physics and mechanics.	§9.4-9.5
9	18	2019-11-05	Series solutions: ordinary points.	§5.1-5.3
	19	2019-11-07	Series solutions: regular singular points.	§5.4-5.6
10	20	2019-11-12	Euler and Bessel	§5.7
	21	2019-11-14	Laplace Transformations and inverse of Laplace transformations.	§6
11	22	2019-11-19	Impulse functions and Convolution. Applications of Laplace transformations in physics and mechanics.	§6
	24	2019-11-21	The Sturm-Liouville eigenvalue problem.	§11.1-11.2
12	25	2019-11-26	**Midterm Exam II**	
	26	2019-11-28	Boundary value problems. Separation of variables.	§11.3-11.5
13	27	2018-12-03	Review of nonlinear systems of ODEs: stability and Lyapunov functions	§9.6
	28	2018-12-05	Review of nonlinear systems of ODEs: periodic solutions and limit cycles, chaos.	§9.7-9.8
14			**Final Exam**	

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