

MATH 134: LINEAR AND NONLINEAR SYSTEMS OF DIFFERENTIAL EQUATIONS

SPRING 2024

Lecture: MWF 10:00-10:50am in Franz 2258A

Course Instructor: Dr. Sarah Tymochko

Email: tymochko@math.ucla.edu

Office: MS 7370

Office Hours: W 11am-12pm, Th 1-2pm in MS 7370

Tuesday Discussion*

10:00-10:50am in Bunche Hall 3157

Teaching Assistant: Reid Johnson

Office Hours: Tu 11:10am-12:10pm in MS 2951

Email: reid@math.ucla.edu

Thursday Discussion*

10:00-10:50am in Bunche Hall 3157

Teaching Assistant: Eric Kim

Office Hours: Tu 3:30-4:30pm in MS 2903

Email: ericykim@math.ucla.edu

Note: Both TAs' office hours are open to all students. You do not have to go to the TA you have discussion with.

Textbook: Nonlinear Dynamics and Chaos, 2nd Edition, by Steven H. Strogatz. ISBN-13: 978-0-8133-4910-7 Note this book is not available via open access but you can download it for free at [this link](#). You must be on UCLA's wifi, then go to that link, and click on "EBSCOhost Ebooks". If you prefer a hard copy, you can order one from the UCLA Store.

Prerequisites: Completion of Math 33B with a grade of D- or better.

Course Description: Math 134 is an introduction to nonlinear dynamical systems, with an emphasis on the study of qualitative properties. The main topics we discuss are: Dynamical systems analysis of nonlinear systems of differential equations. One- and two-dimensional flows. Fixed points, limit cycles, and stability analysis. Bifurcations and normal forms. Elementary geometrical and topological results. Applications to problems in biology, chemistry, physics, and other fields.

Learning Outcomes: By the end of the course students will be able to:

- Use both geometric and analytical techniques to identify equilibria, oscillations, and stability in systems of differential equations.
- Describe a system's dependence on parameters using bifurcation analysis.
- Select the appropriate dynamical systems techniques to apply to a given physical problem, execute those techniques accurately, and interpret the results.

Important Dates:

First Day of Class	April 1
Midterm Exam	May 10
Memorial Day holiday (no class)	May 27
Last Day of Class	June 7
Final Exam*	June 11, 8:00-11:00am

*If there is a discrepancy between what is listed here and what is on myUCLA then go with what it says on myUCLA.

Grading. Grades will be calculated based on the following scheme:

Quizzes	5%
Homework	15%
Midterm	35%
Final Exam	45%

If you take the midterm exam, but then you do better on the final, I will replace your midterm grade by the final exam grade. This can only improve your grade. Note you must take the midterm for this to apply. If you miss the midterm you will get a 0 for that assignment.

Note that I reserve the right to change the grading scheme as I see fit, however it will only be beneficial to your grade. A final average of 90% or higher will guarantee you at least an A-, a final average of 80% or higher will guarantee you at least a B-, and a final average of 70% or higher will guarantee you at least a C-. These letter grade cut-offs may be adjusted downward at the end of the quarter, so that more students receive higher grades. But under no circumstances will the grade cut-offs be higher than stated above: this policy can only help you, not hurt you.

Quizzes. On odd weeks (starting week 3) there will be short, timed quizzes on Gradescope that will be graded on completion only. These will be a good way for both me and you to gauge your understanding of the material throughout the quarter. There will be no makeup quizzes, however the lowest quiz will be dropped. The best way to study for the quizzes is to do the homework. These quizzes are an opportunity for you to reflect on your own understanding of the course with a very low penalty (each quiz is worth only 1%).

Homework. Homework will be assigned weekly and due on Fridays. While I encourage you to turn in your homework on time, a 48 hour grace period will be offered on all homeworks – you do not need to ask for it. However, homeworks **will not** be accepted after this grace period is over. The purpose of the grace period deadline is to allow for difficulties (technical or otherwise) in the submission of homework assignments. The lowest homework grade will be dropped.

We will be using Gradescope to submit assignments. Sending your homework via email will not be counted, it must be uploaded to Gradescope. You are allowed (encouraged even) to work with your classmates on homework problems. However, everyone is required to turn in their own separate solutions. You should write the names of other students you worked with on your assignment. Homework will be graded for correctness and completeness. However, you will not know in advance which problems will be graded for correctness so you are encouraged to try all the problems on the homework sets.

Exams. There will be one midterm exams and one final exam. Exam dates and times are listed on the course schedule. There will be no makeup exams. ***You must take the final to pass the course.*** If you miss the midterm exam, you cannot get an incomplete if you need to miss the final.

OTHER POLICIES AND RESOURCES

Academic Integrity. From the office of the Dean of Students: *“With its status as a world-class research institution, it is critical that the University uphold the highest standards of integrity both inside and outside the classroom. As a student and member of the UCLA community, you are expected to demonstrate integrity in all of your academic endeavors. Accordingly, when accusations of academic dishonesty occur, The Office of Student Conduct is charged with reviewing and adjudicating suspected violations. Academic dishonesty, includes, but is not limited to, cheating, fabrication, plagiarism, multiple submissions or facilitating academic misconduct.”*

Students are expected to be aware of the University policy on academic integrity in the UCLA Student Conduct Code. Violations of the course policy involving plagiarism, cheating, or possession of course materials during exams will be referred to the Dean of Students. **Do not cheat!** The penalties can be very harsh and impact your future after college. If you are found responsible by the Dean of Students for violating course policy, cheating on any course assignments or exams, or giving or receiving unauthorized help, a zero will be assigned for the entire assignment and will not be eligible to be dropped as the lowest grade. No exceptions will be made!

Policy on Online Resources. Students are permitted to use the internet as a supplementary tool for homework assistance. Websites, online forums, and educational platforms can be consulted for better understanding and clarity of topics. When in doubt about the appropriateness of a website or source, students should ask your instructor or TA. Directly copying and pasting content from any source, including websites like Chegg or ChatGPT, is strictly prohibited. Using paid services to complete homework or gain answers is also considered a breach of this policy.

Center for Accessible Education. If you are already registered with the Center for Accessible Education (CAE), please request your Letter of Accommodation in the Student Portal. If you are seeking registration with the CAE, please submit your request for accommodations via the CAE website. Students with disabilities requiring academic accommodations should submit their request for accommodations as soon as possible, as it may take up to two weeks to review the request. For more information, please visit the CAE website (www.cae.ucla.edu), visit the CAE at A255 Murphy Hall, or contact us by phone at (310) 825-1501.

Title IX Resources. UCLA prohibits gender discrimination, including sexual harassment, domestic and dating violence, sexual assault and stalking. If you have experienced sexual harassment or sexual violence, there are a variety of resources to assist you.

- **CONFIDENTIAL Resources:** You can receive confidential support and advocacy at the CARE Advocacy Office for Sexual and Gender-Based Violence and Misconduct. CARE is committed to the eradication of sexual and gender-based violence through creating and sustaining a safe, healthy, and equitable community for all people. Contact CARE at (310) 206-2465 or 24 Hour Crisis Counseling (888) 200-6665.
- **NON-CONFIDENTIAL Resources:** You can also report sexual violence or sexual harassment directly to the University's Title IX Coordinator (2255 Murphy Hall, titleix@equity.ucla.edu, (310) 206-3417). Reports to law enforcement can be made to UCPD at (310) 825-1491. These offices may be required to pursue an official investigation and are NOT confidential.

Please note that faculty and TAs are mandatory reporters and are required under the UC Policy on Sexual Violence and Sexual Harassment to inform the Title IX Coordinator (a NON-CONFIDENTIAL resource) should they become aware that you or any other student has experienced sexual violence or sexual harassment.

Psychological Health, Well-Being and Resilience. UCLA is renowned for academic excellence, and yet we know that many students feel overwhelmed at times by demands to succeed academically, socially, and personally. Our campus community is committed to helping all students thrive, learn to cope with stress, and build resilience. Remember, self-care is a skill that is critical to your long-term success. Here are some of the many resources available at UCLA to support you:

- **Counseling and Psychological Services (CAPS):** <https://counseling.ucla.edu/>. Provides counseling and other psychological/mental health services to students.

- Ashe Student Health and Wellness Center: <https://www.studenthealth.ucla.edu/>. Provides high quality and accessible ambulatory healthcare and education by caring professionals to support the academic success and personal development of all UCLA students.
- Healthy Campus Initiative (HCI): <https://www.healthy.ucla.edu/>. Provides high quality resources for enhancing physical and psychological well-being, positive social interactions, healthy sleep, healthy physical activity and more.
- Resilience In Your Student Experience (RISE): <https://risecenter.ucla.edu/>. Provides programs to promote resilience and trains students to help support their peers.
- UCLA Recreation: <https://recreation.ucla.edu/>. Offers a broad array of services and programs including fitness, yoga, dance, martial arts, meditation, sports, and much more.
- Equity, Diversity, and Inclusion: <https://equity.ucla.edu/>. Committed to providing an equal learning, working, and living environment at UCLA and supports a range of programs to promote these goals campus-wide.
- UCLA Guidance, Resilience, Integrity and Transformation (GRIT) Coaching Program: <https://risecenter.ucla.edu/>. In this program, UCLA students receive individualized support from trained peer coaches to manage stress, fostering positive social connections, set goals, and navigate campus resources.

Dealing with Financial Stress.

- Bruin Shelter: <https://bruinshelter.org/>. Provides a safe, supportive environment for fellow college students experiencing homelessness by fostering a collaborative effort between universities, community-based organizations, and service providers.
- The CPO Food Shelter: <https://cpo.ucla.edu/cpo/foodcloset/>. Provides free food for any UCLA student who may be experiencing hunger and/or struggling to attain food due to financial hardships.