MAT 342: Applied Complex Analysis

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Summer II 2024

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Office Hours: Tue/Th 12pm-1pm   Class Hours: Tue/Th 1:30pm-4:55pm

Office: S-240A, Math Tower   Class Room: Physics 112

Course Description

This a self-contained introduction to complex analysis and some of its applications. Topics covered will include properties of complex numbers, analytic functions with examples, the Cauchy-Riemann and Laplace equations, contour integrals, the Cauchy integral formula, the fundamental theorem of algebra and maximum principle, power series and Laurent series, the Cauchy residue theorem and its applications in evaluating real integrals, conformal mappings, and time permitting, application of conformal maps to solving partial differential equations.

Textbook: *Complex Variables and Applications* by James W. Brown and Ruel V. Churchill, 9th Edition, McGraw-Hill, 2014. We will cover most of the first eight chapters, and whatever time permits from Chapter 9 onwards. *Visual Complex Analysis* by Tristan Needham is another very nice book, with a different presentation and lots of nice pictures and applications.

More information about the course, including material from earlier semesters, can be found on the department course webpage: https://www.math.stonybrook.edu/MAT342

Our first lecture is July 9, 2024. For important dates, see the course schedule: https://www.math.stonybrook.edu/schedules/sumII-24.html

Prerequisites

- You need to have taken a course in multivariable calculus: MAT 203 or MAT 220 or MAT 307 or AMS 261 (Calculus III) in Stony Brook, or an equivalent course elsewhere, with a grade of C or better.

- While this will not be a strictly proof-based course and will focus much more on examples, visualization, and calculations, a familiarity with proofs will nonetheless be useful (some of the content of MAT 200 or MAT 250 in Stony Brook, or equivalent).

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Course Objectives

Through this course we will try to:

1. Understand complex analytic functions and visualize various common examples

2. Understand their connection to harmonic functions, with applications to physical problems

3. Understand the Cauchy integral formula and some surprising mathematical implications

4. Understand the calculus of residues, and apply it to solve integrals

5. Understand conformal maps and their applications

Course Structure

Lectures

Lectures will be in-person, twice a week: Tuesdays and Thursdays 1:30pm-4:55pm at Physics 112. We will, of course, take breaks in between. It is suggested that students attend class, since we will do lots of hands-on problem-solving and doubt-clearing, and if you follow along then the effort required outside lecture hours will be reduced massively.

For help with course material or homework, my tentative office hours are given above. There are also tutors, including me, available throughout the week at the Math Learning Centre (see below).

Assessments

- Homework (weekly): 40 %

- Midterm (25 July, in-class): 15 %

- Final (written exam/presentation): 30 %

- Class participation: 15 %

Grading Policy

Grading will be relative and fairly lenient. A rough estimate can be:

A 100-90; A- 85-89.9

B+ 75-84.9; B 65-74.9; B- 60-64.9

C+ 57.5-59.9; C 52.5-57.4; C- 47.5-52.4

D+ 42.5-47.4; D 40-42.4

F 39.9-0

Course Policies

Student Accessibility Support Center Statement

If you have a physical, psychological, medical, or learning disability that may impact your course work, please contact Stony Brook Union Suite 107, (631)632-6748, or at sasc@stonybrook.edu. They will determine with you what accommodations are necessary and appropriate. All information and documentation is confidential. Students who require assistance during emergency evacuation are encouraged to discuss their needs with their professors and Disability Support Services. For procedures and information go to the website at http://www.stonybrook.edu/ehs/fire/disabilities.

Academic Integrity and Honesty

Each student must pursue their academic goals honestly and be personally accountable for all submitted work. Representing another persons work as your own is always wrong. Faculty are required to report any suspected instance of academic dishonesty to the Academic Judiciary. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website at
https://www.stonybrook.edu/commcms/academic_integrity/index.html

Critical Incident Management

Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of Judicial Affairs any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, and/or inhibits students ability to learn.Further information about most academic matters can be found in the Undergraduate Bulletin, the Undergraduate Class Schedule, and the Faculty-Employee Handbook.

Help

The Math Learning Center (MLC) is located in Math Tower S-235, and offers free help to any student requesting it. It also provides a locale for students wishing to form study groups. You can check the schedule here: https://www.math.stonybrook.edu/mlc/center-hours.html