Complex function

Syllabus Number 2G305
Basic Major Subjects
Requisites 2 credit
KOSHIOKA Yasuhiro

1. Course Description

We will explain various concepts including four arithmetic operations with complex numbers, power series expansions and Euler's formula, complex functions and mapping, elementary functions of complex numbers, regular functions and Cauchy-Riemann relations, complex integrals and residues, and conformal mapping and harmonic functions. We will also examine the harmonic functions applied to fluid mechanics and heat transfer.

2. Course Objectives

In these lectures, we move from real numbers to complex numbers, and expand this to regular functions to complex functions. It is not easy to approach complex numbers and complex functions, but graphing them on a Gaussian plane enables to visualize them on a regular Cartesian coordinate plane, which helps to understand the differentials and integrals of complex functions. The students will gain an understanding not only of various concepts related to complex functions, but also of the theory of lift acting on a wing as an example of applications in fluid mechanics.

3. Grading Policy

Students will be evaluated based on the following two exams.
Mid-term test 30% Test and post-test commentary to help learn later.
Final exam 70%
In addition, as mid-term test's feedback, we will explain the problem after the mid-term exam.
Beside the mid-term exam and final exam, each lecture has the time to practice sample exercises for promotion of understanding. The answer of the exercises will be reflected to the attendance check.

4. Textbook and Reference

Textbook
Textbook: Masato Murakami "Complex Functions", Kaimeisha Co.Ltd.ISBN4-87525-206-4

5. Requirements(Assignments)

It sounds like a very difficult subject when it comes to complex functions, but it is important to understand and use trigonometric functions, exponential functions, knowledge of differential and integral functions, and arc degree methods such as what you learn from high school to the first year of university. Familiarize yourself with the Taylor expansion of real functions and focus on where this is used to define complex functions.
It is necessary to take notes firmly. There are many practice questions listed in the textbook, so write your answers on your notes and practice over and over again.
Related subjects: Flows around wings
Reference books: Shiga Koji "A Trip to Mathematics 7 Days" Kinokuniya Bookstore is a very good book to help you understand complex functions, but unfortunately it was out of print several years ago.

6. Note

7. Schedule

[1]	Imaginary numbers and complex numbers (Imaginary numbers are roots and discriminants of quadratic equations, classifications of numbers)
[2]	Imaginary and complex numbers (addition and subtraction of complex number, complex planes, complex numbers and vectors)
[3]	Power series expansion of functions
[4]	Euler's formula and its applications (Nth root of one, de Moivre's theorem)
[5]	Complex plane and polar form
[6]	Complex function (mapping, quadratic function of complex variable)
[7]	Complex functions (power series expansion of real functions, elementary functions of complex variables)
[8]	Complex functions and derivatives (singularities, regular functions, Cauchy-Riemann relations)
[9]	Intermediate examination, Explanation of the problem
[10]	Integration of complex numbers (Integration of power series, integral formula of real function, contour integral)
[11]	Complex integral (integration along a closed curve, Cauchy's integral theorem)
[12]	Complex integral (residue, Laurent expansion, pole)
[13]	Complex integral (application to integral of real function)
[14]	Conformal mapping (conformal mapping of elementary functions, Jewowski transformation)
[15]	Harmonic function (Laplace equation, application of conformal mapping)