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On-line course materials

MATH20142 - Complex Analysis

Year: 2 - Semester: 2 - Credit Rating: 10

Requisites

Prerequisites

MATH10111 Sets, Numbers and Functions B

MATH10131 Calculus and Vectors B

MATH20111 Real Analysis

Aims

The course unit aims to introduce the basic ideas of complex analysis, with particular emphasis on Cauchy's Theorem and the calculus of residues.

Brief Description

This course introduces the calculus of complex functions of a complex variable. It turns out that complex differentiability is a very strong condition and differentiable functions behave very well. Integration is along paths in the complex plane. The central result of this spectacularly beautiful part of mathematics is Cauchy's Theorem guaranteeing that certain integrals along closed paths are zero. This striking result leads to useful techniques for evaluating real integrals based on the 'calculus of residues'.

Learning Outcomes

On completion of this unit successful students will be able to:

understand the significance of differentiability for complex functions and be familiar with the Cauchy-Riemann equations;

evaluate integrals along a path in the complex plane and understand the statement of Cauchy's Theorem;

compute the Taylor and Laurent expansions of simple functions, determining the nature of the singularities and calculating residues;

use the Cauchy Residue Theorem to evaluate integrals and sum series.

Syllabus

- 1.Series. Complex series, power series and the radius of convergence. [2 lectures]
- 2.Continuity. Continuity of complex functions [2]
- 3.The complex plane. The topology of the complex plane, open sets, paths and continuous functions. [2]
- 4.Differentiation. Differentiable complex functions and the Cauchy-Riemann equations. [2]
- 5.Integration. Integration along paths, the Fundamental Theorem of Calculus, the Estimation Lemma, statement of Cauchy's Theorem. [4]
- 6.Argument and Logarithm. [2]
- 7.Taylor and Laurent Series. Cauchy's Integral Formula and Taylor Series, Zeros and Poles, Laurent Series. [3]
- 8.Residues. Cauchy's Residue Theorem, the evaluation of definite integrals and summation of series. [5]

Teaching & Learning Process (Hours Allocated To)

Lectures	Tutorials/ Example Classes	Practical Work/ Laboratory	Private Study	Total
22	11	0	67	100

Assessment and Feedback

- Coursework; Weighting within unit 20%
- 2 hours end of semester examination; Weighting within unit 80%

Further Reading

Ian Stewart and David Tall, Complex Analysis, Cambridge University Press, 1983.

Staff Involved

Dr Nikita Sidorov - Lecturer

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