Exchange programme Vrije Universiteit

Vrije Universiteit Amsterdam - Exchange programme Vrije Universiteit - 2022-2023

Exchange

Vrije Universiteit Amsterdam offers many English-taught courses in a variety of subjects, ranging from arts & culture and social sciences, neurosciences and computer science, to economics and business administration.

The International Office is responsible for course approval and course registration for exchange students. For details about course registration, requirements, credits, semesters and so on, please visit the exchange programmes webpages.

Partial Differential Equations

Course Code	X_400163
Credits	6.00
Period	P4+5
Course Level	300
Language Of Tuition	English
Faculty	Faculty of Science
Course Coordinator	dr. O. Fabert
Examiner	dr. O. Fabert
Teaching Staff	dr. O. Fabert
Teaching method(s)	Partial Exam, Seminar, Lecture

Course Objective

After this course the student...

1. ...will know basic PDE's from classical physics and the properties of their solutions.

2. ... will be able to derive solution formulas and methods, as well as describe the qualitative properties of solutions in relation to the models in which the PDE's arise.

3. ...will be able to apply Fourier series and transforms to solve linear PDE's explicitly, and master techniques to mathematically validate the resulting solution formulas.

Course Content

An overwhelming number of physical phenomena can be described by partial differential equations (PDEs). This course discusses the basic examples and
methods for their solution. For first order equations as well as for the wave equation we discuss the method of characteristics, and hence the solution of such PDEs by methods from the theory of
ordinary differential equations. For second order equations, in particular for the heat, wave and planar Laplace equation, we discuss the method of
separation of variables. This ties in with the remarkable result of Fourier that almost any periodic function can be represented as a sum of sines and cosines, called its Fourier series; an analogous representation for non-periodic functions is provided by the Fourier transform. We discuss both, together with some theoretical background. Green's functions and fundamental solutions will be discussed for the standard examples: heat,
wave and Poisson equation. While we will mostly be concerned with linear equations and the general solution techniques that exist for them, we will also make short excursions into the fascinating world of nonlinear PDEs and discuss unique solution methods for the nonlinear transport equation and its generalizations, Burger's equation and Korteweg-de Vries equation.

Topics:

- Classical examples
- First order equations and characteristics
- d'Alembert's solution for the wave equation
- Separation of variables for second order equations
- Fourier series and Fourier transform
- The Dirac delta-function and generalized functions

- Green's functions and fundamental solutions for heat and wave equation
- Travelling wave solutions for Burger's equation and Korteweg-de Vries equation
- The Dirichlet principle

Additional Information Teaching Methods

Lectures and exercise classes (both 2 hours per week)

Method of Assessment

Two written exams and two homework sets, with weights 4+4+1+1=10, make up your final grade. The grades for these exams and homework sets are cancelled in case the student takes the resit exam, which counts for 100%.

Entry Requirements

Linear algebra, Calculus, Analysis

Literature

Peter J. Olver, "Introduction to Partial Differential Equations", Springer-Verlag, New York, 2014. ISBN 978-3-319-02099-0.

Additional Information Target Audience

Bachelor Mathematics Year 3

Custom Course Registration

Registration via Canvas