Transform Theory

Programme course

4 credits

Transformteori

TATA57

Valid from: 2017 Spring semester

Determined by
Board of Studies for Industrial Engineering and Logistics

Date determined
2017-01-25

Main field of study
Mathematics, Applied Mathematics

Course level
First cycle

Advancement level
G1F

Course offered for
- Industrial Engineering and Management - International, M Sc in Engineering
- Biomedical Engineering, M Sc in Engineering
- Applied Physics and Electrical Engineering - International, M Sc in Engineering
- Physics, Bachelor´s Programme

Entry requirements
Note: Admission requirements for non-programme students usually also include admission requirements for the programme and threshold requirements for progression within the programme, or corresponding.

Prerequisites
Calculus, linear algebra

Intended learning outcomes
The course aims to give students a deeper knowledge of Fourier analysis and Transform Theory , which have many applications in both technology and mathematics. After successfully completing the course the student is expected to

- be acquainted with necessary conditions for the existence of the transforms,
- know and be able to derive simple properties of the transforms (e.g. behaviour at infinity, scaling and translation rules, rules for differentiation and integration as well as rules for multiplication by the time variable).
- be able to derive the transforms of the elementary funktions,
- know the invversion theorems, uniqueness theorems, the convolution formulas and the Parseval and Plancherel theorems,
- be able to use the transforms to solve problems such as differential equations, Difference equations and convolution equations
- be acquainted with and be able to use results about uniform convergence (continuity, differentiability and integrability of limit functions, Weierstrass' Majorant Theorem).

Course content

In this course we study some important linear transformations which allow us to translate linear problems (differential, integral and difference equations) into more tractable algebraic problems, whose solutions can then be translated back to solutions of the original problem.
We study: Fourier series, which translate periodic functions into function series. These series are used to analyze periodic behaviour. The problem of convergence of the function series is important and we look att uniform and pointwise convergence as well as convergence in the mean for Fourier series. Bessel's and Parseval's Theorems are key results. Fourier transforms: these transforms are used to analyze non-periodic behaviour. The inversion formula for Fourier transforms is of central importance, and other tools at our disposal include the rules of calculation, the convolution formula and Plancherel's Theorem. The Laplace transform: this transforms functions of a real variable into functions defined in the complex plane and it is used amongst other things for solving initial value problems. The tools at our disposal include rules of calculation, the convolution formula as well as initial and final value theorems. The Z-transform: transforms functions of the natural numbers into power series, and it is used to solve difference equations. The tools at our disposal include rules of calculation and the convolution formula.

Teaching and working methods

Teaching is done through lectures and problem classes.

Examination

TEN1	Written examination	4 credits	U, 3, 4, 5

Grades

Four-grade scale, LiU, U, 3, 4, 5

Department

Matematiska institutionen

Director of Studies or equivalent

Jesper Thorén

Examiner

Peter Basarab-Horwath

Education components

Preliminary scheduled hours: 46 h
Recommended self-study hours: 61 h

Course literature

Pinkus, A., Zafrany, S.: Fourier Series and Integral Transforms. Kompletterande material (exempelsamling) utgivet av MAI.

Common rules

Regulations (apply to LiU in its entirety)

The university is a government agency whose operations are regulated by legislation and ordinances, which include the Higher Education Act and the Higher Education Ordinance. In addition to legislation and ordinances, operations are subject to several policy documents. The Linköping University rule book collects currently valid decisions of a regulatory nature taken by the university board, the vice-chancellor and faculty/department boards.

LiU's rule book for education at first-cycle and second-cycle levels is available at http://styrdokument.liu.se/Regelsamling/Innehall/Utbildning_pa_grund-_och_avancerad_niva.