| | |
|---|---|
| Objective | Deeper mathematical understanding of the foundations of signal processing and system theory. The setting of Banach Gelfand Triples allows to provide a framework that allows among others to discuss the relations between different settings (e.g. the generalized Fourier transform of functions on the Euclidean space and corresponding FFT-based routines). |
| Content | Time-Frequency Analysis and its discretized version, namely Gabor Analysis have required to develop a family of function spaces (the so-called modulation spaces, introduced by Feichtinger in the 80th) which is different from the usual Lebesgue spaces. There is a smallest space (called S_0) and a largest space (namely the dual space), which is a suitable reservoir of generalized functions relevant for the rigorous establishment of basic results in signal processing (sampling theorem, Poisson formula, Fourier inversion, etc.). The course will be centered about the basic properties of the Banach Gelfand triple (S_0,L2,S_0') (also called rigged Hilbert space), its use for signal processing and systems theory applications. In addition to classical questions we will also discuss the fundamental results of time-frequency analysis (Short-time Fourier transform, Gabor frames, Gabor multipliers, best approximation of operators by Gabor multipliers, identification of slowly varying channels using pilote tones, etc.). |
| Lecture notes | There will a script related to the course. In fact, material for a book project on the subject is developed while the course is given. |
| Prerequisites / notice | In principle a good understanding of concepts from linear algebra is sufficient. Of course, basic knowledge about functional analysis (Banach and Hilbert spaces, linear operators and linear functionals) is helpful. We will, however, explain all these concepts as we go along. We will not need background on Lebesgue integration or topological vector spaces (as usually required for the treatment of distributions). |

## ►► Core Courses and Electives (Mathematics Master)

*Core Courses (Mathematics Master)*

*Electives (Mathematics Master)*

## ► Minor Courses

| Number | Title | Type | ECTS | Hours | Lecturers |
|---|---|---|---|---|---|
| **401-1511-00L** | **Geometry** | **W** | **3 credits** | **2V+1U** | **L. Halbeisen** |
| Abstract | Im Mittelpunkt dieser Vorlesung steht die euklidische und die projektive Geometrie. | | | | |
| Objective | Axiomatischer Aufbau der euklidischen Geometrie mit Hilfe der Axiome von Hilbert. Klassische Saetze der projektive Geometrie. | | | | |
| Content | Im ersten Teil der Vorlesung wird die euklidische Geometrie axiomatisch aufgebaut. Das dazu verwendete Axiomensystem stammt von David Hilbert.<br>Nach einer kurzen Einfuehrung in die projektive Geometrie werden dann in einem zweiten Teil die klassischen Saetze der projektiven Geometrie bewiesen. Dazu gehoeren z.B. die Saetze von Desargues, Pappos, Menelaos, Ceva, Pascal und Brianchon. | | | | |
| Literature | Robin Hartshorne: "Geometry: Euclid and beyond", Springer Verlag<br>Eric Lord: "Symmetry and Pattern in Projective Geometry", Springer Verlag | | | | |
| **402-0351-00L** | **Astronomy** | **W** | **2 credits** | **2V** | **H. M. Schmid**, W. Schmutz |
| Abstract | An overview on the important topics in modern astronomy: planets, sun, stars, milky way, galaxies, and cosmology | | | | |
| Objective | This lecture gives a general introduction to main topics in modern astronomy. The lecture provide a basis for the more advanced lectures in astrophysics. | | | | |
| Content | Planeten, Sonne, Sterne, Milchstrasse, Galaxien und Kosmologie. | | | | |
| Lecture notes | Kopien der Präsentationen werde zur Verfügung gestellt. | | | | |
| Literature | Astronomie. Harry Nussbaumer, Hans Martin Schmid<br>vdf Vorlesungsskripte (8. Auflage)<br><br>Der Neue Kosmos. A. Unsöld, B. Baschek, Springer | | | | |

## ► Seminars

*Early enrolments for seminars in myStudies are encouraged, so that we will recognize need for additional seminars in a timely manner. Some seminars have waiting lists. Nevertheless, register for at most two mathematics seminars. In this case, you express a stronger preference for the seminar for which you register earlier.*

| Number | Title | Type | ECTS | Hours | Lecturers |
|---|---|---|---|---|---|
| **401-3050-65L** | **Student Seminar in Combinatorics: Linear Complementarity**<br>*Number of participants limited to 18.* | **W** | **4 credits** | **2S** | **K. Fukuda** |
| Abstract | We study the combinatorics and the complexity of various subclasses of the linear complementarity problem. | | | | |
| Objective | To understand the importance of linear complementarity as a common generalization of linear programming, bimatrix games and convex quadratic programming. | | | | |
| Content | The Linear Complementarity Problem (LCP) was introduced in mid 1960's (1965-67) by Lemke and Cottle-Dantzig as a common generalization of linear programming, bimatrix game and convex quadratic programming.<br>The problem is NP-hard in general, but there are many subclasses of LCP that are in P (polynomially solvable) or suspected to be in P. The reason for the possible polynomially solvability is that these studied subclasses (e.g. P-matrix LCPs and positive-definite LCPs) can be formulated as a problem which admits a solution that has a succinct certificate for its correctness. Moreover, there are elegant combinatorial abstractions of these subclasses.<br><br>In this seminar, we study the most important papers/books, both old and new, in the theory of LCP, and aim at understanding what is crucial lack of knowledge in proving or disproving existing conjectures. | | | | |
| Literature | To be posted here before the first class on September 15.<br><br>The seminar schedule and a list of articles:<br>http://www.inf.ethz.ch/personal/fukudak/lect/lcsemi/lcseminar2015_ref.pdf<br>(Version October 7, 2015). Please check the version date, as it gets updated frequently.<br><br>Accepted Reports:<br>http://www.inf.ethz.ch/personal/fukudak/lect/lcsemi/reports<br><br>The slides of the overview (Revised on September 22, 2015):<br>http://www-oldurls.inf.ethz.ch/personal/fukudak/lect/lcsemi/LCPandCrissCross1509.pdf . | | | | |
| Prerequisites / notice | Basic knowlege of linear programming. | | | | |
| **401-3320-65L** | **Algebraic Groups and Actions**<br>*The seminar is for more advanced students. Registration is officially closed, but if Prof. Doran agrees, further* | **W** | **4 credits** | **2S** | **B. R. Doran** |