Prof. Andreas Rosenschon: Algebraic Geometrie - Curves and Surfaces WS 2019-20

Place and Time: Thursdays 10-12 in B 251.

Literatur: Hartshorne 'Algebraic Geometry'; Chapters IV and V.

This seminar involves applications of the language developed in Algebraic Geometry I-II to curves and surfaces with the aim of a classification of these objects. The goal of these talks is to motivate and explain the relevant notions and theorems; because of the amount of material needed to do this, it won't be possible to prove every necessary statement in detail.

Tentative Program:

31.10. [Weinzierl] "Cohomology of schemes": survey talk; Serre-Duality (without proof).

7.11. [Weinzierl] "Riemann-Roch for curves": introduction of the notion of the genus of a curve, as well as complete linear systems and canonical divisors in the context of curves. Theorem of Riemann-Roch for curves (without proof or sketch of proof) with applications.

21.11. [Rosenschon] "Theorem of Hurwitz": finite morphisms of curves, ramification and ramification divisors, proof of the Theorem of Hurwitz for a finite separable morphism of curves. Application: Theorem of Lüroth (the necessary statements about morphisms of curves corresponding to purely inseparable field extensions are to be used without proof).

28.11 [Mattis] "Embedding into projective space I": connection between linear systems and embeddings into projective space in the context of curves.

5.12. [Mattis] "Embedding into projective space II": Proof of the Theorem that every curve admits an embedding into $\mathbb{P}^3$; explanation of the Theorem that every curve in $\mathbb{P}^3$ admits a birational morphism to $\mathbb{P}^2$.

12.12 [Balkan] "Canoncial Embedding": hyperelliptic curves, canonical embedding and canonical curves, existence of a unique $g_{1,2}$ for hyperelliptic curves, Theorem of Clifford (without proof).

19.12. [Rosenschon] "Classification of curves and moduli": survey talk.

9.1. [Balkan] "Geomerty of surfaces": intersection pairing for divisors on surfaces, adjunction formula.

16.1. [Paulsen] “Riemann-Roch for divisors on surfaces”: sketch of proof (using Serre duality); applications: Hodge Index Theorem (with proof), criterion of Nakai-Moishezon (without proof).

23.1. [Paulsen] “Blowups of points on surfaces”: elementary properties, behaviour of a curve under such a blowup, resolution of curves on surfaces (without proof), example of a cusp.

30.1. “Birational transformation of surfaces”: Zariski’s Main Theorem, every birational transformation of surfaces factors as a finite sequenz of blowups of points and their inverses.

6.2. “Theorem of Castelnuovo”: sketch of proof, minimal model of a surface.

13.2. “Classification of surfaces”: survey talk, Kodaira dimension, explicit examples of surfaces occuring in the classification.