

LTCC Advanced Course

- Title: Model Theory
- Lecturer Details:
 - Lecturer: Dr Ivan Tomašić
 - Lecturer home institution: Queen Mary, University of London
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- Basic Details:
 - Core Audience: 2nd/3rd year: pure
 - Course Format: extended (10 hours at 2 hours per week)
 - Timing: early autumn 2009
- Course Description:

Overview

This course is an introduction to the methods of model theory, with a view toward applications in algebra, algebraic geometry and number theory.

There are two prominent directions of pure model-theoretic research. On the quantitative side, one is interested in counting the number of models of a certain theory. On the other, qualitative side, one tries to identify the types of (classical) mathematical structures present in a given model-theoretic framework.

The course is designed to reflect a recent notable shift of interest in model-theoretic research, from the quantitative to the qualitative, from counting to structure, as well as to illustrate the groundbreaking applications of model-theoretic methods in number theory by Hrushovski. Thus, it might be useful to students with various backgrounds and research interests.

Topics to be covered:

1. First order logic: Languages, Structures, Completeness, Compactness.
2. Basic model theory: Existence of models (Löwenheim-Skolem Theorem), elementary substructures, types, Stone spaces.
3. Applications in algebra: model theory of algebraically closed fields, quantifier elimination, model-completeness, Nullstellensatz.
4. Dimension, rank, stability: Morley's Theorem, Macintyre's Theorem (an infinite ω -stable field is algebraically closed).
5. Qualitative vs quantitative analysis: Classification Theory and Zilber's Trichotomy, model-theoretic background of Hrushovski's proof of the Mordell-Lang conjecture.

Literature:

- E. Bouscaren (Ed.) **Model Theory and Algebraic Geometry. (An introduction to E. Hrushovski's proof of the geometric Mordell-Lang conjecture)**. Lecture Notes in Mathematics **1696**, Springer, 1998.
- C. C. Chang and H. J. Keisler. **Model Theory**. Studies in Logic and the Foundations of Math. **73**, North-Holland Publishing Co., Amsterdam, 1990.
- D. Haskell, A. Pillay, C. Steinhorn (Eds.). **Model Theory, Algebra, and Geometry**. MSRI Publications, Volume **39**, 2000.
- W. Hodges, **Model Theory**. Encyclopedia of Mathematics and its Applications **42**, Cambridge University Press, Cambridge, 1993.