MATH-735

Topics in geometric group theory

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Cursus	Sem.	Type
Mathematics		Opt.

Language of teaching	English
Credits	3
Session	
Exam	Oral presentation
Workload	90h
Hours	**72**
Courses	24
TP	24
Project	24
Number of positions	**20**

Frequency

Only this year

Remark

This course addresses PhD students interested in groups theory, geometry and the interactions between these two fields. Fall semester - Wednesdays from 23.09.2020

Summary

The goal of this course/seminar is to introduce the students to some contemporary aspects of geometric group theory. Emphasis will be put on Artin's Braid groups and Thompson's groups.

Content

The goal of this course/seminar is to introduce the students to some contemporary aspects of geometric group theory.
The general philosophy of this subject is to associate to a finitely group a geometric object (namely its Cayley graph) and to investigate the relation between the algebraic and the geometric properties of the group. Some of these relations are very deep and have
non trivial algebraic and/or geometric consequences. A special emphasis will be devoted to Artin's groups and the Thompson Group.
The following is a tentative plan of the course, which we shall adapt to the background and taste of the participants :
1. Basic concepts and a few striking though classical results.
1a. Finitely generated group as a geometric object: the word metric and the Cayley graph.
1b. The notion of quasi-isometry and example of quasi-isometry invariants
1b. Growth of group. The Milnor-Svarc Theorem and Gromov's Theorem on virtually nilpotent groups.
1c. The notion of Gromov Hyperbolic groups.
2. Braid Groups and Artin Group
2a. Defintions and presentation by generators and relations.
2b. The braid group and configuration spaces.
2c. Applications to Riemann surfaces, moduly spaces and monodromy.
3. The Thompson group
3c. Finite and infinite presentations, normal forms for elements.
3d. Simplicity and normal subgroup structure.
3e. Subgroup structure, the Brin-Squier theorem and distortion.
3f. Finiteness properties, the Brown-Geoghegan theorem and BNS invariants.
3g. Dehn functions.
3h Fordham's algorithm for computing word length.
3i. Groups of piecewise projective homeomorphisms.

Keywords

Braid groups, Artin groups, Thompson Groups, Cayley graph, quasi-isometry invariants

Learning Prerequisites

Important concepts to start the course

To follow this course the student should have some familiarity with basic group theory and algebraic topology (covering maps and fundamental groups). Some differential geometry will be helpful.

Resources

Bibliography

A bibliography will be provided. Some useful books are :
- Office Hours with a Geometric Group Theorist, Edited by Matt Clay & Dan Margalit.
- Topics in geometric group theory.Â Pierre de la Harpe (2000).
- Geometric group theory.Â Â DruÅ£u, Cornelia; Kapovich, Michael 2018.
- A course on geometric group theory,Â Â Bowditch, Brian (2014) [An easy introduction]
- Braids, links, and mapping class groups. Birman, Joan S.
-Â Braids, Riemann surfaces and moduli. William Harvey.

Ressources en bibliothèque

- ffice Hours with a Geometric Group Theorist
- Topics in geometric group theory
- Geometric group theory
- A course on geometric group theory
- Braids, links, and mapping class groups.

Websites

- https://wiki.epfl.ch/grtr/ggt2020