On-line course materials

MATH42112 - Lie Algebras

Year: 4 - **Semester:** 2 - **Credit Rating:** 15

Aims

To introduce students to some more sophisticated concepts and results of Lie theory as an essential part of general mathematical culture and as a basis for further study of more advanced mathematics.

Brief Description

The course unit will deal with finite-dimensional Lie algebras, that is, with anticommutative algebras satisfying the Jacobi identity. These algebras have various applications in representation theory, mathematical physics, geometry, engineering and computer graphics. Lie theory is currently a very active area of research and provides many interesting examples and patterns to other branches of mathematics.

Learning Outcomes

On successful completion of the course students will have acquired:

- A sound understanding of basic concepts of the theory Lie algebras.
- Knowledge of some fundamental results of the theory of Lie algebras.
- Knowledge of the Killing-Cartan classification of the finite dimensional simple Lie algebras.

Syllabus

- Definitions and first examples. Ideals and homomorphisms. [4]
- Nilpotent Lie algebras. Engel's theorem. [3]
- Solvable Lie algebras. Lie's theorem. Radical and semisimplicity. [3]
- The Killing form and Cartan's criterion. [2]
- The structure of semisimple Lie algebras. [3]
- Representation theory of the Lie algebra sl(2). [3]
- Toral subalgebras and root systems. Integrality properties. Simple Lie algebras and irreducible root systems. [4]

For MATH42112 the lectures will be enhanced by additional reading on related topics.

Teaching & Learning Process (Hours Allocated To)

Lectures	Tutorials/ Example Classes	Practical Work/ Laboratory	Private Study	Total
22	11	0	117	150

Assessment and Feedback

Coursework: weighted 15%

Examination: of 3 hours duration and weighted 80% 85%

Further Reading

- Karin Erdmann andMark J. Wildon *Introduction to Lie Algebras,* Springer Undergraduate Mathematics Series, Springer-Verlag London Limited, 2006.
- J.E. Humphreys *Introduction to Lie Algebras and Representation Theory*, Graduate Texts in Mathematics, Springer, 1972.

Staff Involved

Prof Alexander Premet - Lecturer

Data source is EPS system

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