Course: Symmetry group analysis of differential equations	
Teacher(s): Sanja Konjik	
Course status: elective	
ECTS: 12	
Prerequisites: None	
Goal: Acquiring knowledge and skills from selected topics of symmetry group analysis of differential equations	
Outcomes: Student is able to independently follow the achievements in the field of symmetry group analysis and to apply the acquired knowledge and skills to specific problems	

Contents

Theoretical lectures

Transformation of manifold, Lie group, group of transformations, Lie group of transformations, local vector fields, local diffeomorphism, orbits, distributions on manifolds, rank, involutive sets and distributions, integral manifolds of distribution, integrable distributions, infinitesimal automorphism of distribution, initial submanifold, Frobenius theorem, local Lie transformation group, orbit of the local transformation group, infinitesimal generator, connected, semi-regular and regular local transformation groups, local and global G-invariance, infinitesimal criterion, Hadamard's lemma, functionally dependence, Buckingham Pi-theorem, symmetry group, prolongations, maximal rank, total derivative, prolongation formula, calculation of symmetry groups, local solvability, nondegeneracy conditions, integration of ODEs, differential invariants, variational problems, variational derivative, Euler's operator, Euler-Lagrange equations, variational symmetry, total divergence, infinitesimal criterion for variational symmetries, conservation laws, Noether's theorem, infinitesimal divergence symmetry, characteristics

Recommended bibliography

1. Kunzinger, M., Lie Transformation Groups - An Introduction to Symmetry Group Analysis of Differential Equations, Lecture notes, University of Vienna, 2015.
2. Olver, P.J., Applications of Lie Groups to Differential Equations, 2nd edition, Springer, New York, 2000.
3. Olver, P.J., Equivalence, Invariants, and Symettry, Cambridge University Press, Cambridge, 2009.
4. Warner, F.W., Foundations of Differentiable Manifolds and Lie Groups, Springer-Verlag, New York, 1983.
5. Hall, B., Lie Groups, Lie Algebras, and Representations - An Elementary Introduction, Springer, Switzerland, 2015.

Active teaching hours: 5	Theoretical: 5	Practical:

Methods of teaching:
Theoretical lectures and individual work of students during practical hours

Knowledge estimation: **(max 100 points)**
Mini-project 20 points, oral exam 80 points