

Seminar: Completely Integrable Systems II: Mathematical Methods of Classical Mechanics (WS21/22)

Lecturer: JProf. Dr. Xian Liao

Time: Friday 14:00-15:30

Place: SR -1.009 (UG) 20.30 (or online if the present form is not permitted)

Contents: This seminar is a continuation of the seminar ([Completely Integrable System I](#)) held online in SS2021 at KIT. We propose to continue with Arnold's well-known book [1] on the mathematical methods on classical mechanics.

We will begin with a review talk on the materials covered in SS2021

0. Newtonian mechanics and Lagrangian mechanics (Sections 1-21 [1])

and propose the following topics:

1. Linearization and small oscillations. (Sections 22-23 [1])
2. Characteristic frequencies and parametric resonance. (Sections 24-25 [1])
3. Inertial forces and Coriolis force. (Sections 26-27 [1])
4. Rigid bodies. (Sections 28-29 [1])
5. Lagrange's top. (Sections 30-31 [1])
6. Exterior forms and differential forms. (Sections 32-34 [1])
7. Exterior differentiation. (Sections 35-36 [1])
8. Symplectic structure and Lie algebra. (Sections 37-40 [1])
9. Symplectic geometry. (Sections 41-43 [1])
10. Integral invariant of Poincaré-Cartan. (Sections 44-45 [1])
11. Huygens' principle. (Section 46 [1])
12. Hamilton's equations. (Sections 47-48 [1])
13. Action-angle variables. (Sections 49-50 [1])
14. Averaging. (Sections 51-52 [1])

Reference:

1. V.I. Arnold, Mathematical Methods of Classical Mechanics. Second Edition. Springer. 1989.

Prerequisites: Analysis I-III, Linear Algebra.

Remarks: If you are interested in participating in this seminar, please write an email (with possibly interested topics) to xian.liao@kit.edu before 04.10.2021. The participants will be added to the corresponding MS Team, where all the up-to-date information will be announced.

There will be an online meeting to distribute the topics at the beginning of October.

We recommend the English presentations, but German is also possible if all other participants agree.