

Topics in topology: Topological robotics

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Outline: We will present certain problems in robotics that can be solved using topological methods. The main concepts that will be considered are the following: configuration space and working space of a robot; kinematic and inverse kinematic maps and their singularities; motion planning in robotics, topological complexity of motion and manipulation planning; homotopy invariance of topological complexity, upper and lower bounds for complexity.

Literature:

- M. Farber, Topological complexity of motion planning, *Discrete Comput Geom* 29 (2003) 211–221.
- M. Farber, *Invitation to topological robotics*, European Mathematical Society, 2008.
- P. Pavešić, A Topologist's View of Kinematic Maps and Manipulation Complexity, *Contemp. Math.* 702 (2018), 61–83.
- A. Hatcher, *Algebraic Topology*, Cambridge University Press 2002.

Prerequisites: Some of the topics will require methods that are usually treated in algebraic topology courses (basic constructions in homotopy theory, homology groups). If necessary, these topics will be briefly recalled during the course.

Assessment: Depending on the specific problem, the students will prepare and present a short project or a seminar.

Semester: Spring

Weekly hours: 3/2

Language: Slovenian or English (depending on students enrolled in the course)

The course will also be offered to PhD students.