Robotics and Computer vision (RoVi)

Robotics - introduction information

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M.Sc – Mechatronics,
Ph.D – Robotics (robot control in contact with the environment)

Research filed:

- → Robot control, learning, human robot interaction, industrial robotics,
- → Part design and optimization,
- → Robot grasping

Course information

→Robotics and Computer vision:
- → Lectures (theoretical approach) check lectures plan,
- → examples,
- → exercises,
- → 1 hand-in.

→Tools:
- → python robotic toolbox, Mujoco, LaTex, MATLAB.
- → Programming languages:
  - → Phyton, MATLAB scripting.

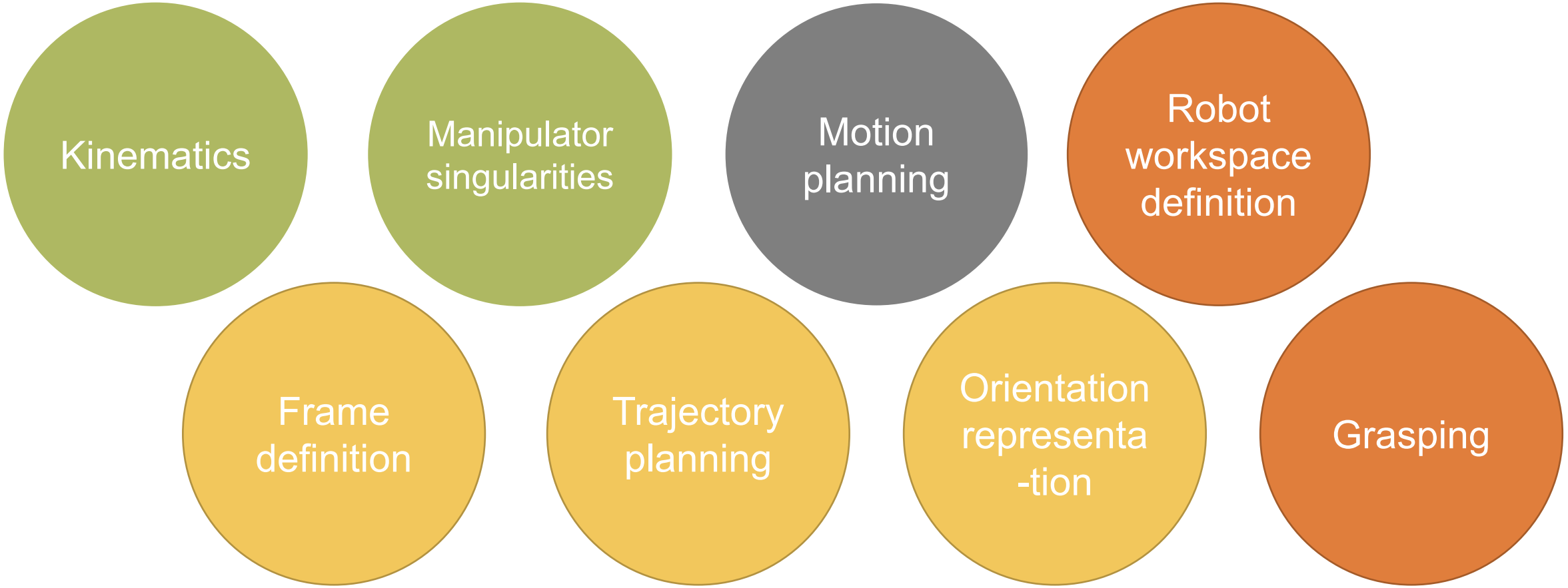
→Literature:
- → Siciliano, Bruno, Lorenzo Sciavicco, Luigi Villani, and Giuseppe Oriolo. Robotics: modelling, planning and control. Springer Science & Business Media, 2010, doi. 10.1007/978-1-84628-642-1
- → Mihelj M., Bajd T., Ude A., et al. Robotics. 2nd Edition, 2019, Springer, https://doi.org/10.1007/978-3-319-72911-4 ,
- → Siciliano B., Khatib O., Handbook of Robotics, 2nd Edition, 2016, Springer, https://doi.org/10.1007/978-3-319-32552-1 ,
- → Internet

Prerequisites

→ Kinematics,
→ frame structures,
→ spaces
→ definitions of poses in 3D space,
→ state vectors,
→ rotation matrix,
→ rotation around coordinate axis,
→ RPY angles,
→ homogeneous coordinates transforms,
→ forward kinematics, D-H method, transformation frames,
→ compute the state of the manipulator.

Mihelj M., Bajd T., Ude A., et al. Robotics. 2nd Edition, 2019, Springer, https://doi.org/10.1007/978-3-319-72911-4 , chapter 1-4.

Topics in robotics we will cover in the course



Course topics – robotics (subject to change)

Lectures	Topic
Robotics 1	Introduction to robotics, Recap of Kinematics, Recap of frames and orientation definitions, rotation representation in quaternion space
Robotics 2	Equivalent angle-axis, Singularities and joint limits, Definition of the robots workspace
Robotics 3	Inverse kinematics problem, analytical and numerical solution, Derivation of the Jacobian
Robotics 4	Introduction to Linear Interpolation Methods, Point to point movement, Parabolic blends
Robotics 5	Cubic polynomial interpolation for trajectory planning
Robotics 6	Introduction to robot motion planning, Path planning with probabilistic roadmaps
Robotics 7	Kinodynamic motion planning, Path optimization, Task constrained motion planning
Robotics 8	Learning by Demonstration and Digital twins
Robotics 9	Grasping
Robotics 10	Robot grasping and collaborative robots

Questions?