Autonomous and Mobile Robotics

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Wheeled Mobile Robots I

Mechanics of Mobile Robots

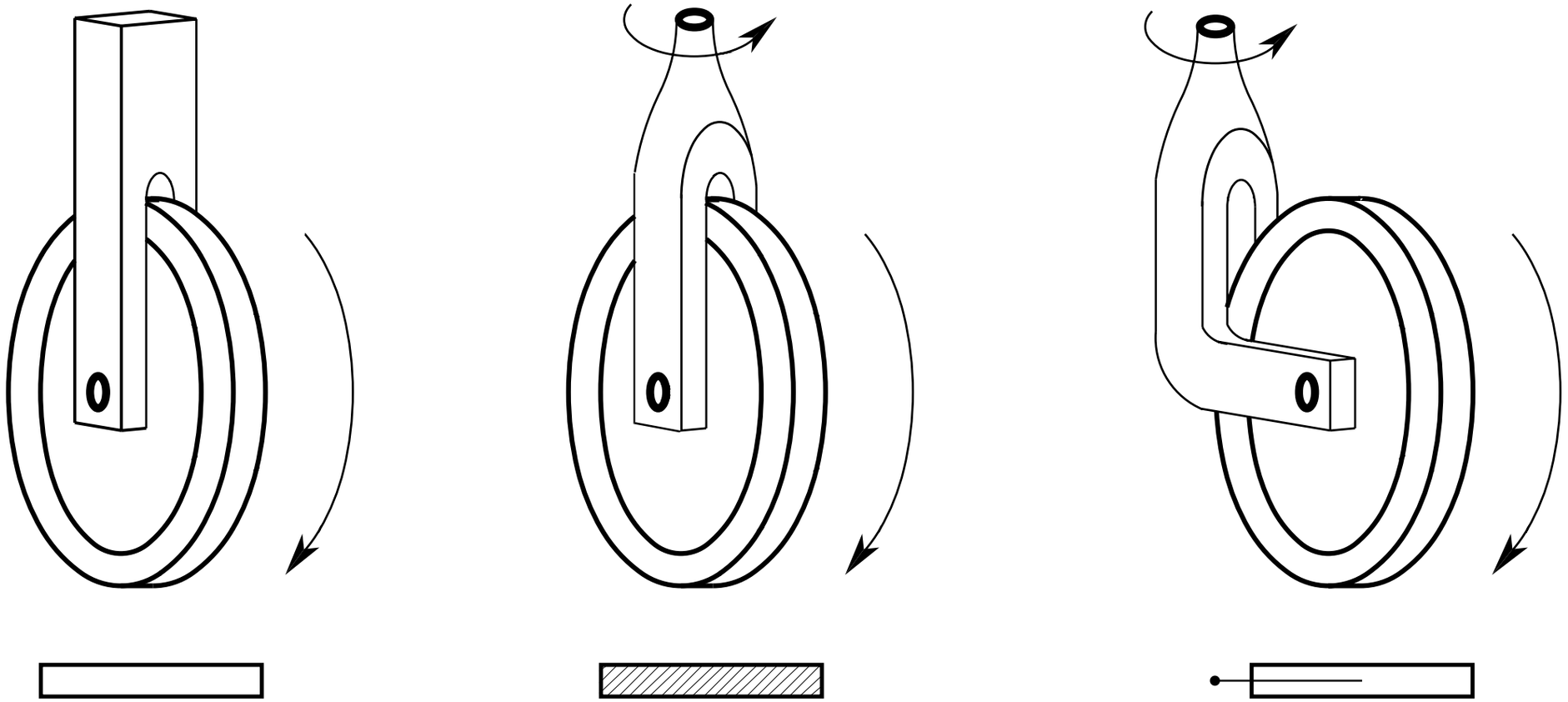
companion slides for the blackboard lecture

DIPARTIMENTO DI INGEGNERIA INFORMATICA
AUTOMATICA E GESTIONALE ANTONIO RUBERTI

SAPIENZA
UNIVERSITÀ DI ROMA

wheels

three basic types

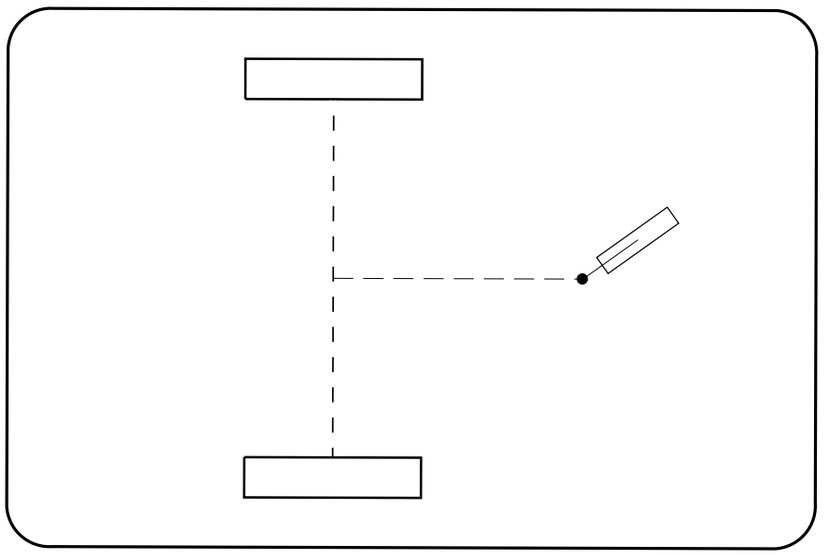


fixed

orientable
(steerable)

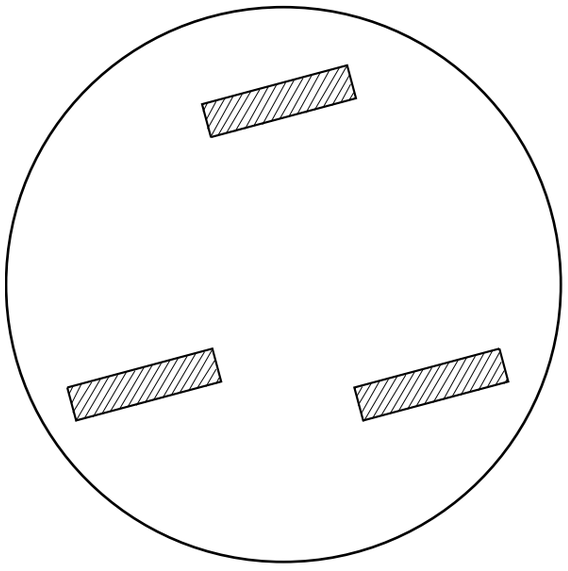
caster

kinematic structures



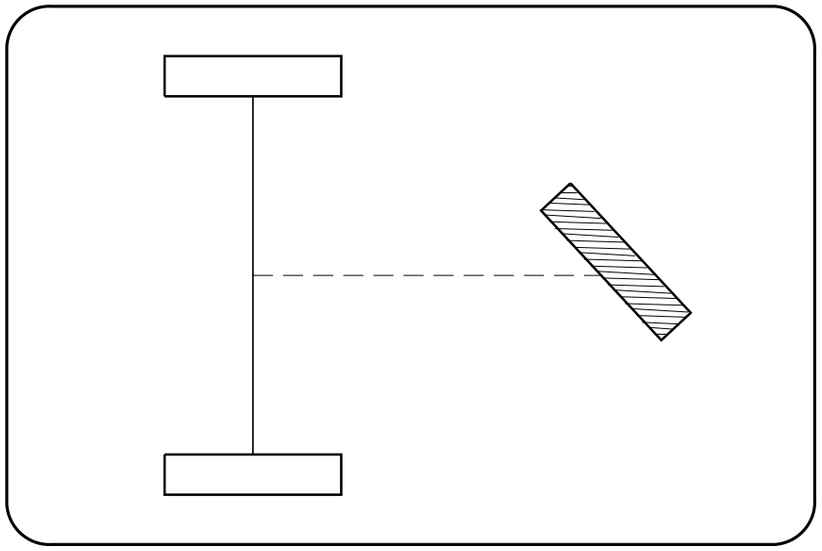
differential-drive mobile robot

kinematic structures

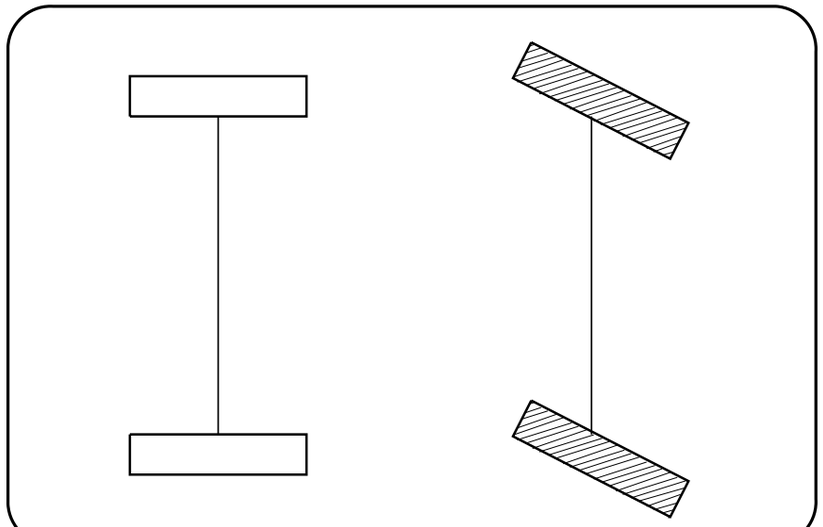


synchro-drive mobile robot

kinematic structures

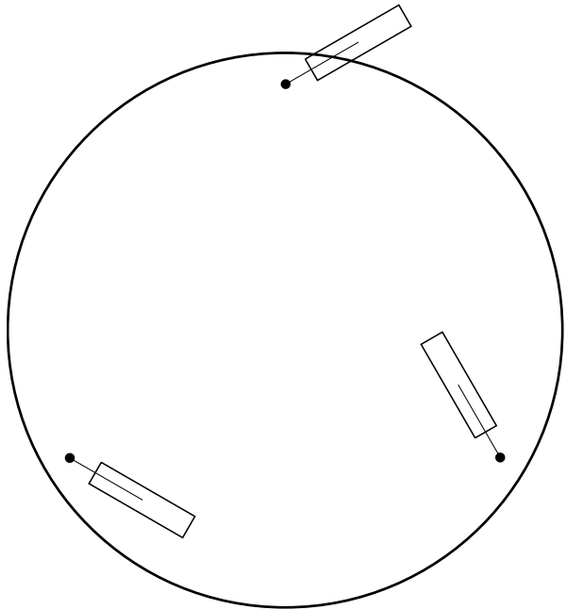


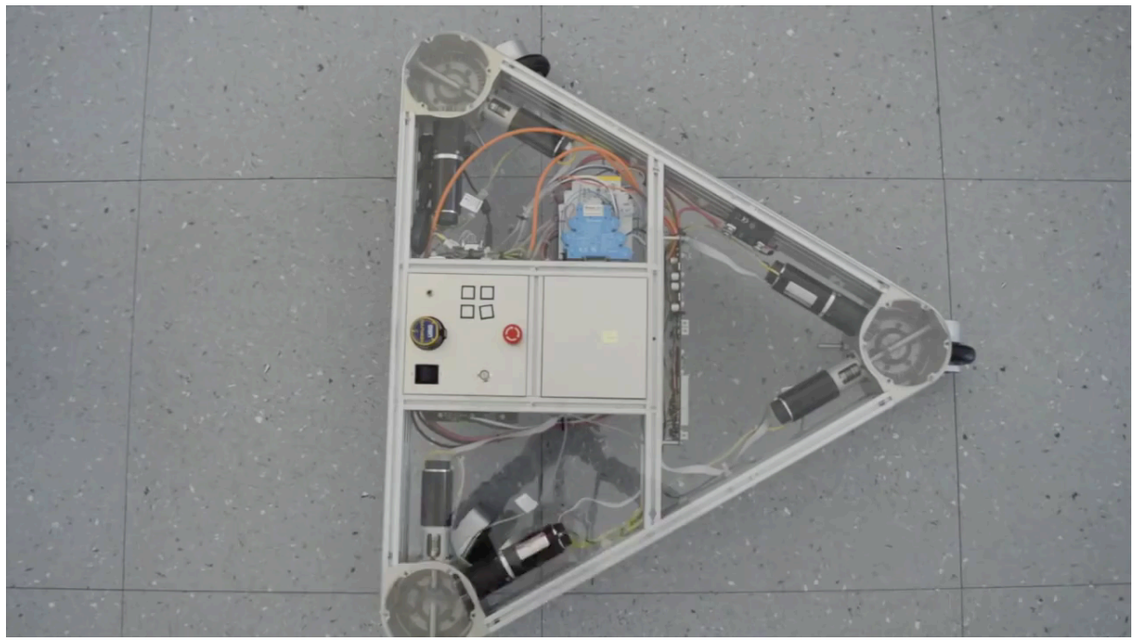
tricycle



car-like

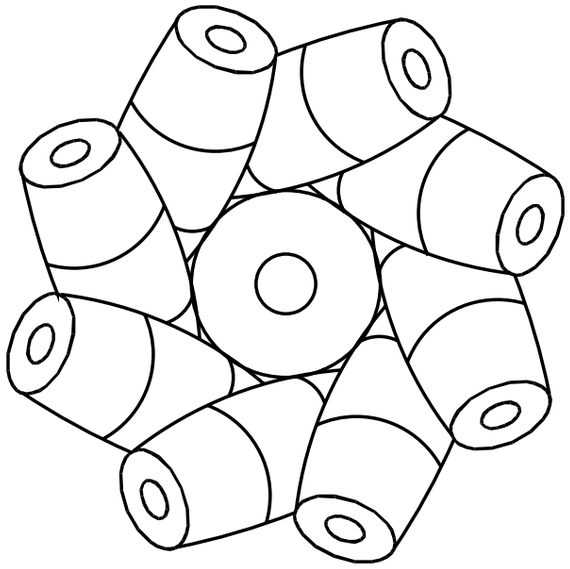
kinematic structures





omnidirectional mobile robot with
3 (actuated) caster wheels

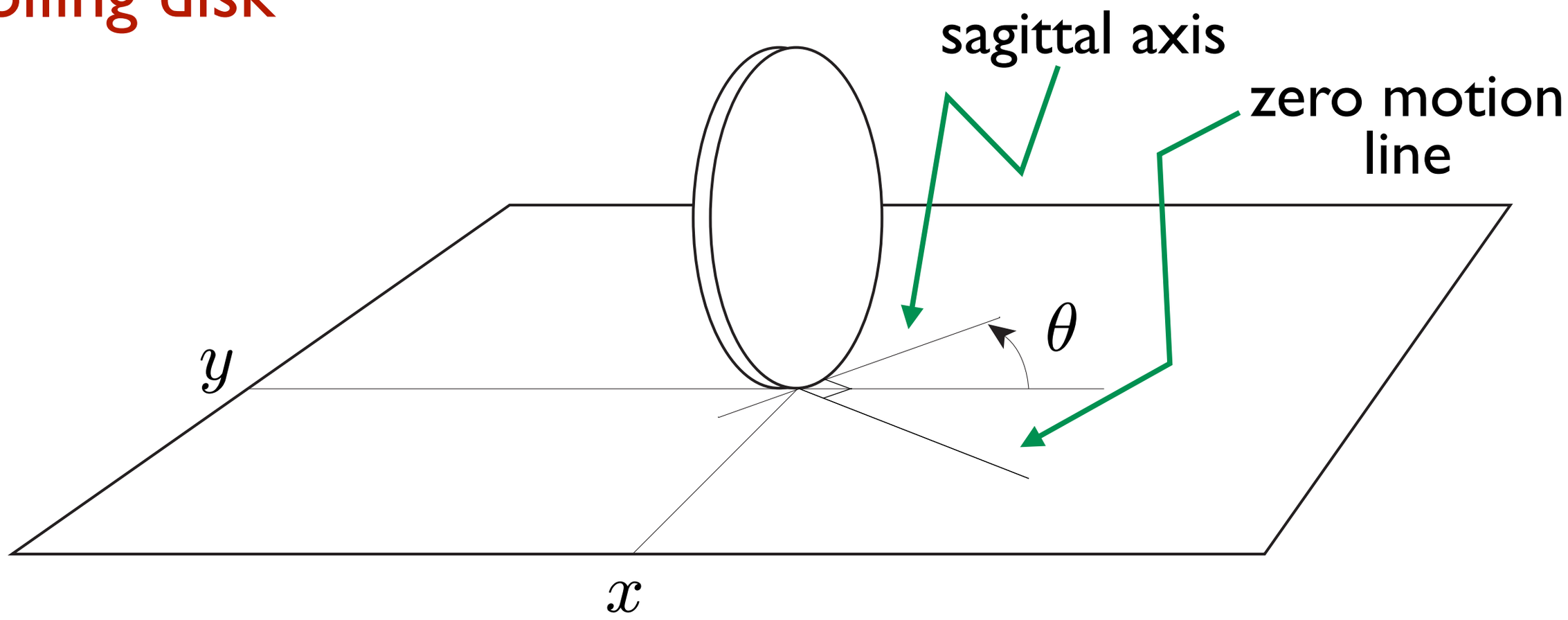
kinematic structures



Mecanum (Swedish) wheels can be also used to build omnidirectional mobile robots

example of nonholonomic constraint

rolling disk



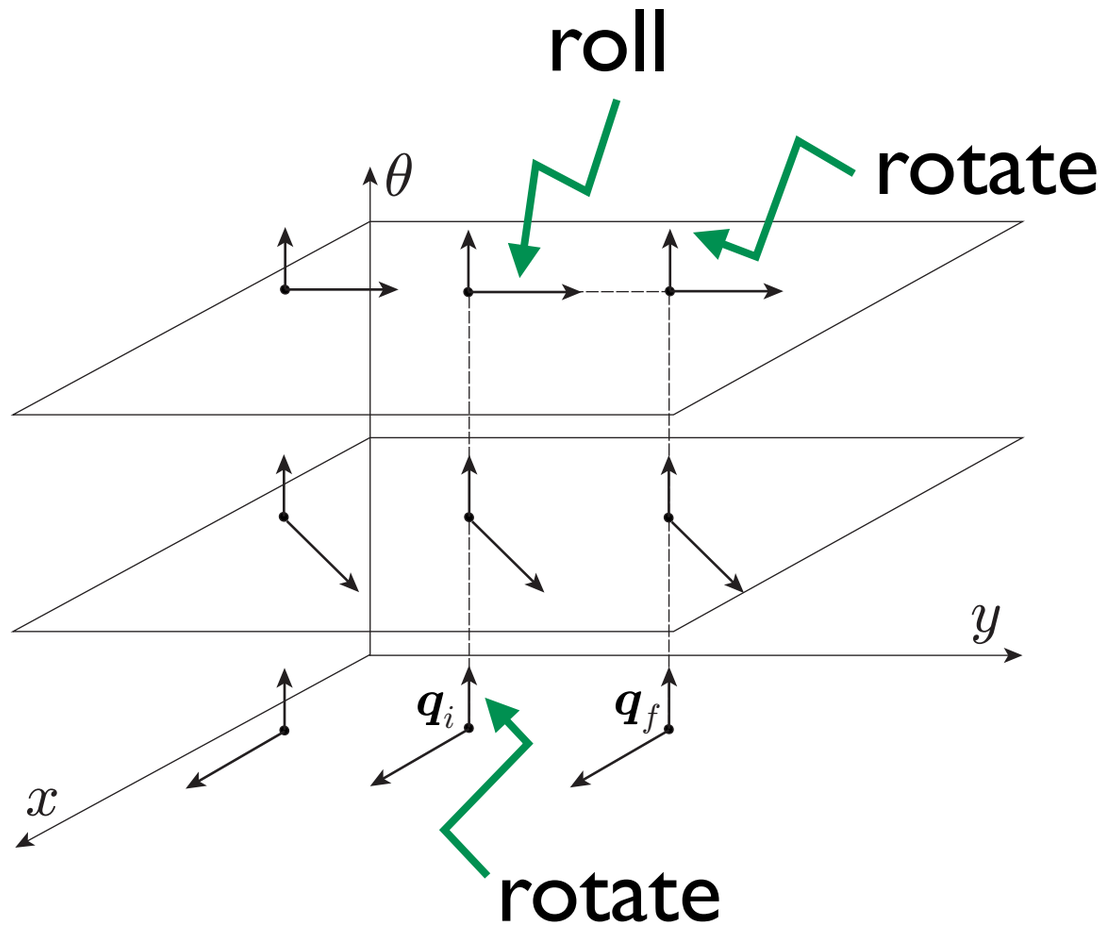
generalized coordinates $\boldsymbol{q} = [\, x \quad y \quad \theta \,]^T$

pure rolling $\dot{x}\sin\theta - \dot{y}\cos\theta = [\, \sin\theta \quad -\cos\theta \quad 0 \,]\, \dot{\boldsymbol{q}} = 0$

the disk can go from any initial to any final configuration

e.g.

1. rotate so as to align with the final position
2. roll up to the final position
3. rotate up to the final orientation



hence, the rolling constraint is nonholonomic