

Exercise Problems for Module 9

- [P9.1] Consider two flat planes meeting at an angle and a WMR with two wheels, modelled as thin disks, and a fixed-length (rigid) axle moving on it in a way such that two wheels are on the two different planes. From Waldron (1995) or from first principles, show that the two-wheeled mobile robot with the rigid axle will slip while moving on this piece-wise flat terrain.
- [P9.2] From the paper by Montana (1988) or first principles derive the contact equations used for single-point contact.
- [P9.3] Consider a sphere rolling on a flat surface. Derive the contact equations and show that a sphere rolling on a flat surface gives rise to non-holonomic constraints.
- [P9.4] Obtain the kinematic equations of the three-wheeled mobile robot moving on a flat surface.
- [P9.5] On a flat surface, the three-wheeled mobile robot has two degrees of freedom. What is the relationship between the three inputs which will enable the three-wheeled mobile robot to move without slip on a flat surface.