



MECHANICAL ENGINEERING MSc SEMINAR (30 min.)

Thursday, July 10 2025 at 13:30-14:00, D. Dan and Betty Kahn Building, Room 217 Also online: Zoom Link

Investigating generalized models of the dynamics of the Twistcar vehicle

Rom Levy

Adviser: Prof. Yizhar Or

Underactuated wheeled vehicles are commonly studied as nonholonomic systems with periodic actuation. Twistcar is a classical example inspired by a riding toy, which has been analyzed using a planar model of a dynamical system with nonholonomic constraints. In this work, we study a theoretical twolink model of the Twistcar with rolling resistance in the form of viscous dissipation. We conduct numerical simulations and obtain asymptotic expressions for its small-amplitude steady-state periodic dynamics. The analysis reveals the possibility of reversing the direction of motion upon varying the geometric and mass properties of the vehicle. Next, we compare the theoretical solution with experimental results obtained in a previous study using a modular robotic prototype of the Twistcar. This comparison involves parameter fitting for the frictional resistance and demonstration of the Twistcar's direction reversal phenomenon. We also consider other effects, such as wheels' skidding dissipation, and use a similar approach to analyze their influence.



Figure 1 – The Twistcar vehicle. (a) The original riding toy. (b) Theoretical two-link model. (c) Robotic Prototype.

Note: the seminar will be given in English