

Integrating Mathematics and Educational Robotics: Simple Motion Planning

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- 1 **Goal**
- 2 **Assumptions**
- 3 **Using Algebra and Trigonometry**
 - Linear regression
 - Solve for motor ticks or time in terms of distance or angle
 - Analyze alternative trajectories
- 4 **Conclusion**

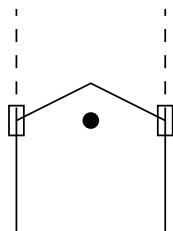
Show students how to apply intermediate-level mathematics to robot motion planning:

- linear regression
- algebra
- trigonometry
- *no* calculus

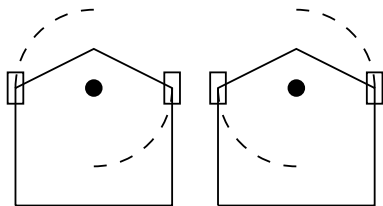
Assumptions

Differential-drive robot

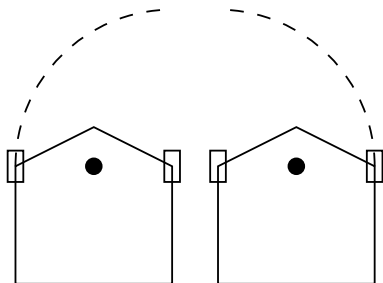
Bounded wheel velocities.
3 main motion types.



straight



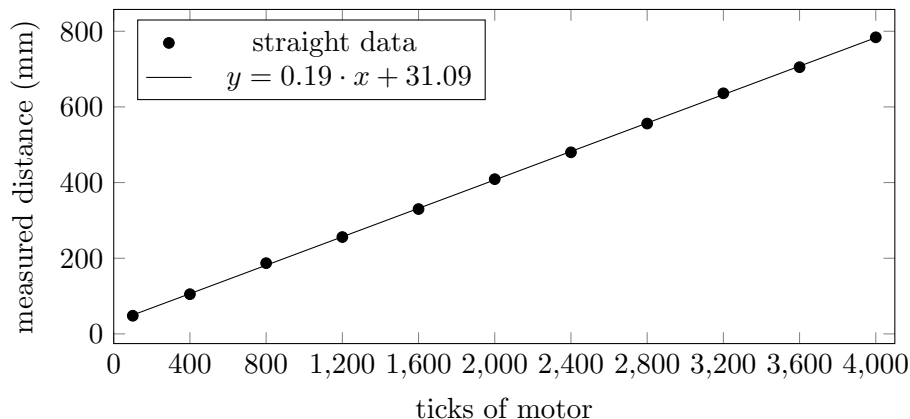
rotations



swings

Linear regression

Use a spreadsheet program
(could use timing delays instead of motor ticks)



Solve for motor ticks or time in terms of distance or angle

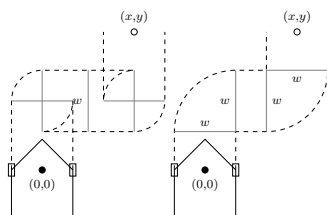
For driving straight:

Solve for motor ticks or time in terms of distance.

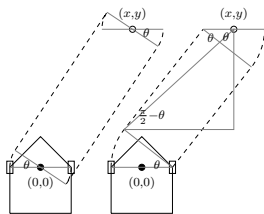
For rotations and swings:

- Measure angle turned in degrees.
- Perform radian/degree conversion.
- Compute travel distances as turn radius times angle.
- Solve for motor ticks or time in terms of angle.

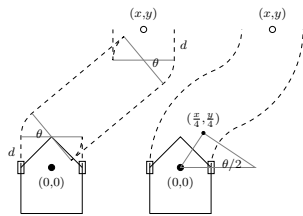
Analyze alternative trajectories



rectilinear
rotations
vs
swings



general
rotations
vs
swings



additional
variations

Conclusion

- We have shown a number of ways for students to apply intermediate-level mathematics to robot motion planning
- Student-directed worksheets are in development and testing with students.