Science Virtual Learning

MPI Physics

Rotational Kinematics 7: The Bicycle Problem

April 15, 2020

Lesson: MPI Rotational Kinematics 7 – Bicycle Problem
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Objective: To apply tangential and angular velocity to understand how a bicycle works

$v = \omega r$

Velocity of bike = spin rate* Radius

A Pennyfarthing bike uses a low spin rate and a big radius to create its velocity

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Modern bikes use a high spin rate and smaller radius

- The following video discusses how bikes use gears and chains to create a high rotation speed for the wheel.
- https://youtu.be/mSUGRfYii38

Video: The Bicycle Problem

- The following video sets up and then solves a long example of calculating rotational and tangential velocities for an actual bicycle.
- https://youtu.be/p64nSNIA0tg

Video: Bicycle Example

A bicycle has a front gear of radius 0.105 m, which is attached to the pedals that rotate at 90.0 rot/min. A chain wraps around the front gear, and also around the back gear, which has a radius of 0.0300 m. The back gear is attached to the back wheel, of radius 0.334 m, which rotate together.

a) What is the angular velocity of the front gear?

b) What is the tangential speed of the chain?

c) What is the angular velocity of the back gear (and wheel)?

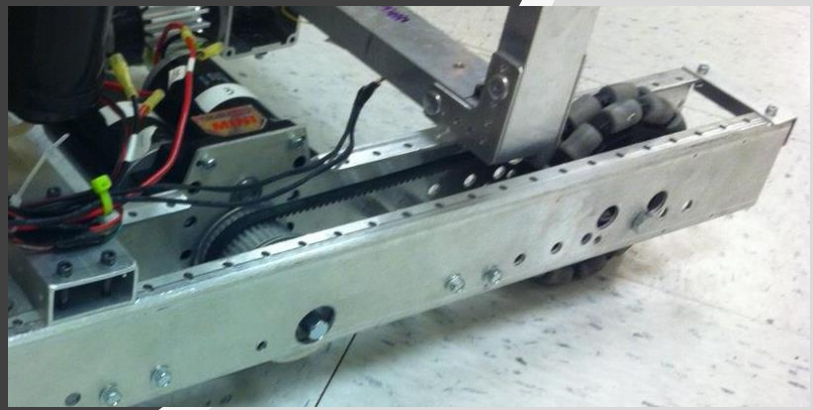
d) At what velocity does the bike move?

Text: Bicycle Example

Homework

The drive motor of a robot is attached to a gear of radius 0.0320 m. A belt runs over the gear to a smaller, 0.0175 m gear attached to the front wheel, which has a radius of 0.0510 m. The robot drives at 3.00 m/s.

a) What is the angular velocity of the wheel?
b) What is the tangential velocity of the belt?
c) What is the angular velocity of the gear on the motor?



- Try to solve the problem yourself, then watch the solution videos:
- https://youtu.be/-jqctMkxIt8
- https://youtu.be/RiUCYdEMcUQ

That’s it!