

1. Exercise:

The participants of the “Tour de France” ride on their bikes at an average speed of $v = 45 \frac{\text{km}}{\text{h}}$. Suppose the stage has a distance of $s = 300 \text{ km}$. The wheels have a diameter of $d = 70 \text{ cm}$.

- (a) When does the bikes reach the finish?
- (b) How often do the wheels turn around?
- (c) What is the time of circulation T of a reflector on the wheel?
- (d) Find the angular velocity ω and the frequency f of the wheels!
- (e) Determine the absolute value of the acceleration a the spokes of the wheel has to withstand.

2. Exercise:

Consider two persons standing on a whirligig, a rotating disc with radius r , at constant angular velocity ω . One person is standing at the middle point, the other one at the border. The one at the border likes to throw a ball to the person in the middle with some certain velocity v .

- (a) What is the velocity v_b of the person at the border?
- (b) At what angle α in the plane of the disc and with respect to the line joining the persons does the person have to throw the ball.
- (c) How long will it take until the ball reaches the person in the middle?
- (d) Now suppose the person can only throw the ball with a maximum velocity v_{max} . What is the maximal angular velocity ω_{max} allowing the person at the border to reach the person in the middle with the ball?
- (e) Consider the person in the middle who wants to throw back the ball to the person outside. In which direction does he have to throw the ball and how long will it take?