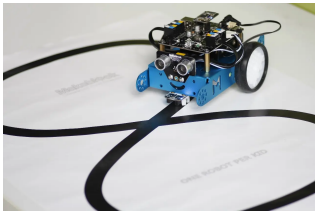
Big HW 1

Particle kinematics

Innopolis University

Task description

We have a mobile vehicle, which should survive after the track. We have some predefined trajectory, which is given in $y(x)$ format.



The **goal** is to pass this trajectory as fast as possible. But at the end of the path, there is a drop-off. It means that the vehicle should stop in the end.

We have to establish some constraints, such as max tangent acceleration (max power on the motor), normal acceleration (road adhesion).

How the vehicle should move (speed and acceleration) for solving such a task?

Report:

1. Vehicle simulation on the path. You should show a $\bar{v}$, $\bar{a}$, $\bar{a}_\tau$, $\bar{a}_n$ on the simulation.
2. plots: $y(t)$, $v(t)$, $a_t(t)$, $a_n(t)$, — t is time in seconds.

Parameters:

$y(x) = Ax \ln(\frac{x}{B})$, where $A = 3$, $B = 5$, $x \in [0..4]$

$a_{t_{max}} = 2$, $a_{n_{max}} = 3$, $v_{max} = 3$

Hints

- Trapezoidal velocity and acceleration (subfolder «extra material»)
- Change between coordinate and natural forms (1st lab slides, theory)
- Curvature (1st Week HW)
- It’s not a task about control. Your vehicle should move ideally along the trajectory.

Deserve “A” grade!

– Oleg Bulichev

o.bulichev@innopolis.ru

@Lupasic

Room 105 (Underground robotics lab)