UNIVERSITY OF PADOVA

DEPARTMENT OF INFORMATION ENGINEERING

DIPARTIMENTO DI INGEGNERIA DELL'INFORMAZIONE

Robotics & Control 2 (R&C2)

Laurea Magistrale in Control Systems Engineering (II year - I semester)

Angelo Cenedese

Lecture NN – Project presentation

A.Y.2024-25

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The “urban mobility challenge”

- **Problem:** ***An AGV has to travel along a closed circuit avoiding the other AGVs that are parked along the path; at the completion of one lap, the AGV has to get off the circuit and park at the box***

  - You will have to deal with the control of one unicycle robot along a given path with:
    - **Phase 1:** definition of the scenario with choice and characterization of the path (trajectory to be tracked) and positioning of the box
    - **Phase 2:** tracking task along a closed trajectory
    - **Phase 3:** obstacle avoidance procedure
    - **Phase 4:** regulation task from the trajectory point to the box

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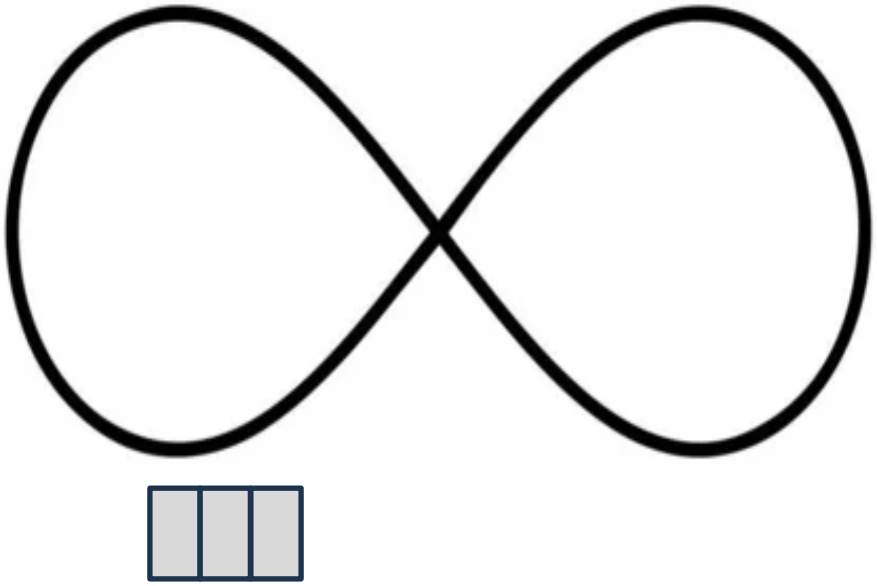
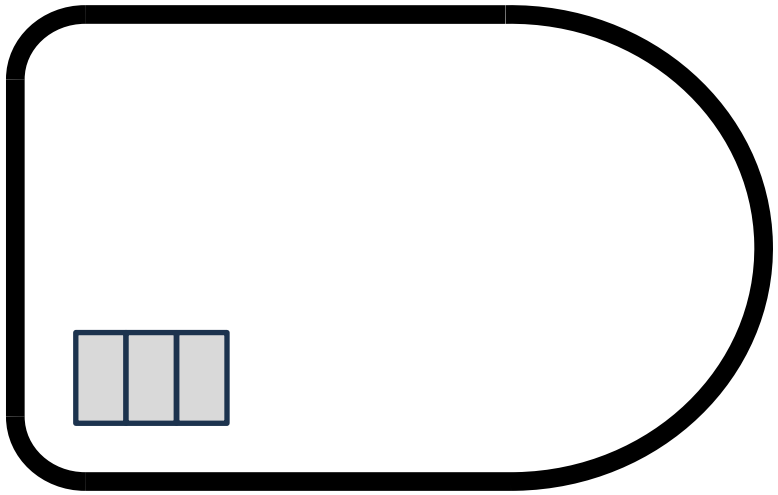
  - **Phase 1:** definition of the scenario with choice and characterization of the path (trajectory to be tracked) and positioning of the box





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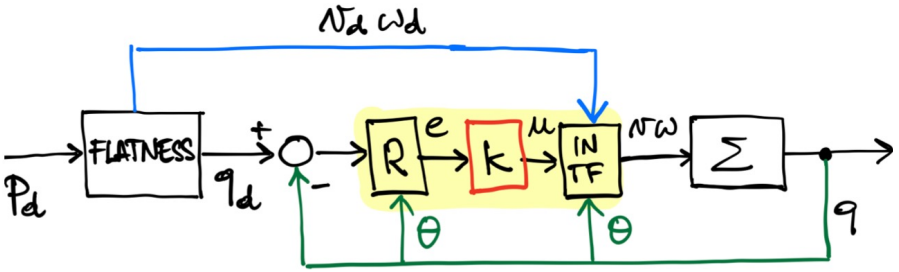
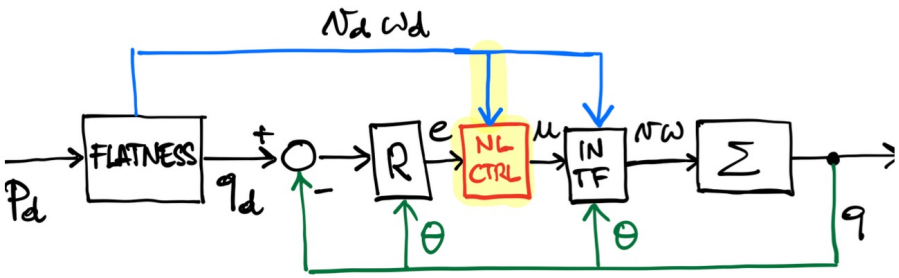
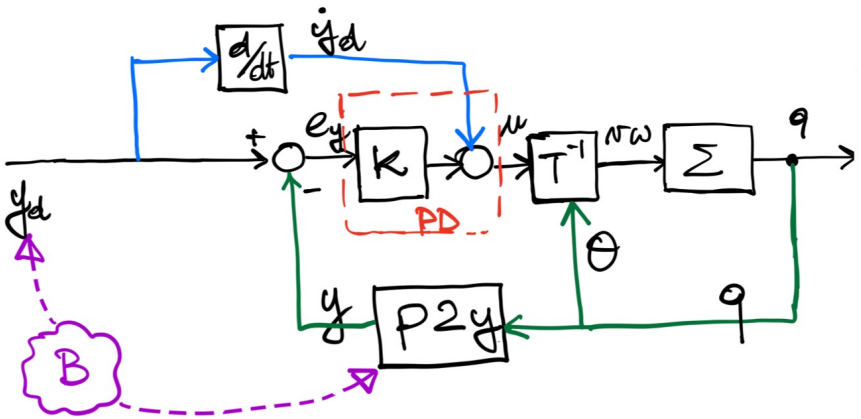
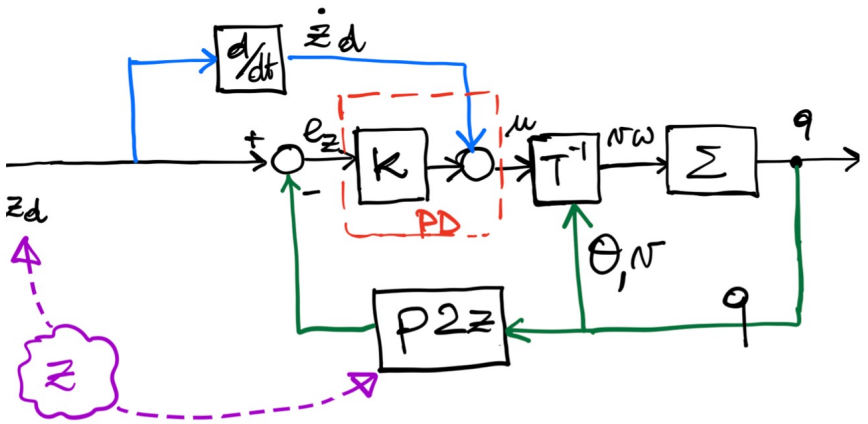
- **Problem:** ***An AGV has to travel along a closed circuit avoiding the other AGVs that are parked along the path; at the completion of one lap, the AGV has to get off the circuit and park at the box***

  - **Phase 2:** tracking task along a closed trajectory









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- **Problem:** ***An AGV has to travel along a closed circuit avoiding the other AGVs that are parked along the path; at the completion of one lap, the AGV has to get off the circuit and park at the box***

  - **Phase 3:** obstacle avoidance procedure
    - Design an automatic detection of obstacles (e.g. by simulating a distance sensor)
    - Design an avoidance procedure
    - Design a re-initialization of the tracking task

The “urban mobility challenge”

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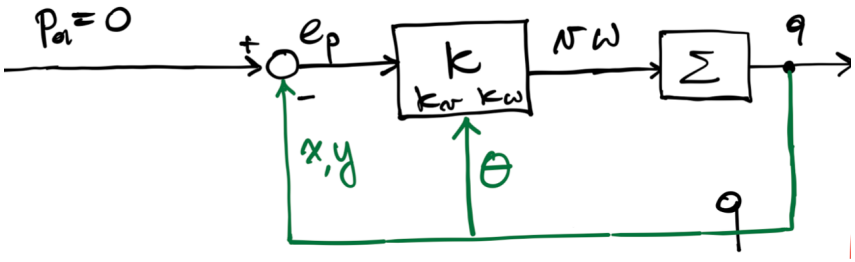
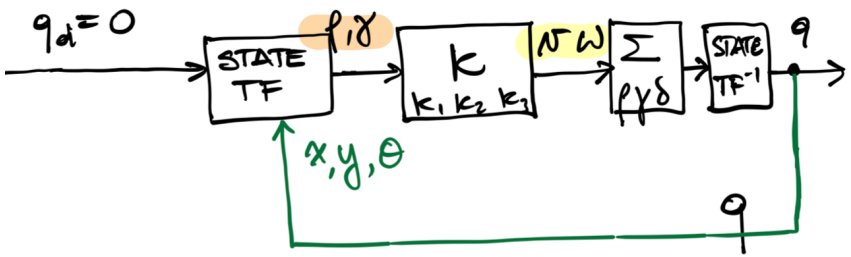
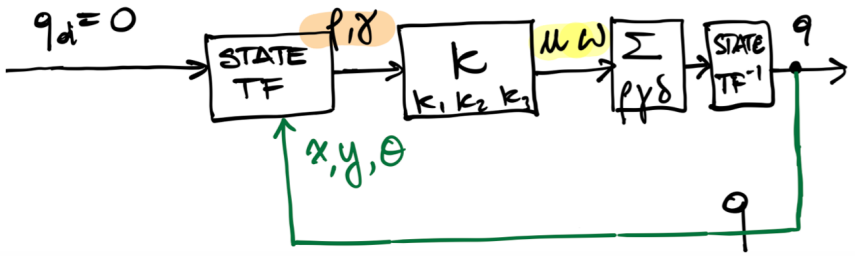
  - **Phase 4:** regulation task from the trajectory point to the box







Implementation notes:

- **Patch zero**

```
function inputs = fcn(velocities,err)

d = 1/sqrt(2);
a = 10;
vd = velocities(1);
wd = velocities(2);

k1 = 2*d*a;

if abs(vd) < 1e-4
     if vd >= 0
          vd = 1e-4;
     else
          vd = -1e-4;
     end
end

k2 = (a^2 - wd^2)/vd;
k3 = k1;
k = [-k1,0,0;
0,-k2,-k3];


inputs = k*err;
```