

## Lab 4: Centralized Platoon Control 1

### Exercise 1. (*Centralized platoon control preparation*)

Your goal in this exercise is to prepare platooning using centralized model predictive control. Use the folder TEAMREPO/+cPMC for this exercise.

- a) Draw the coupling graph and the communication graph representing the agent interaction of the networked control system (NCS).
- b) Find a suitable state-space representation of the NCS consisting of all agents, and provide it in TEAMREPO/+cPMC/central\_model.m.
- c) Draw a sketch of the coordinate system(s) you are using for states and/or outputs that correspond to distances.
- d) Think about possible reasons why `quadprog` may not find a feasible solution if you used it to optimize the inter-vehicle distance. Implement a slack variable for the output in the class `ModelPredictiveControl` using the exact penalty method.



In order to implement the exact penalty method, have the slack variable appear in the linear term of the cost function with a high weight (e.g.  $10^6$ ) and constrain it to be positive.

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### Checkpoint 1

Get a tutor to check your work. You should be able to

- show the coupling graph and communication graph
  - explain the state-space model of the NCS
  - visualize the system states and/or outputs that correspond to distances
  - demonstrate that the slack variable on the output is working on the position control of one vehicle with a constraint on the output
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