Weekly meeting #2

Modelling of platoons

Mustafa Al-Janabi

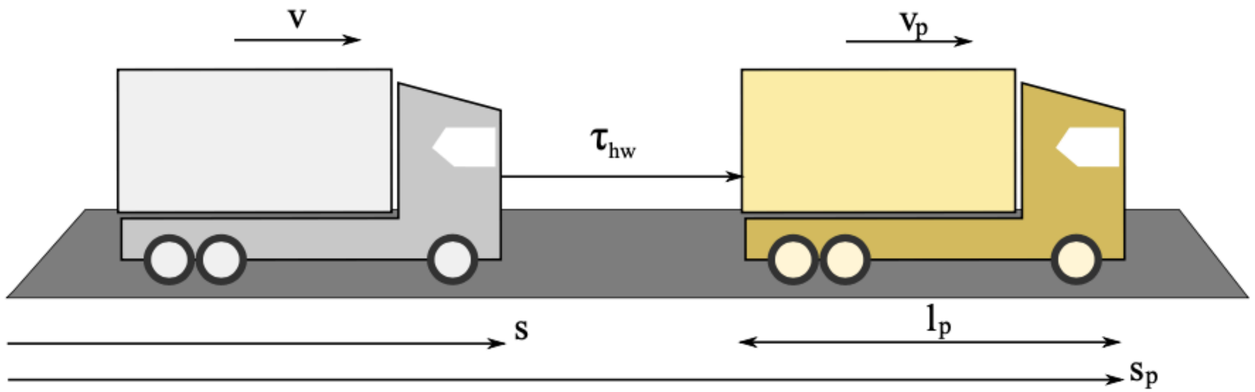
22.04.2021

Agenda

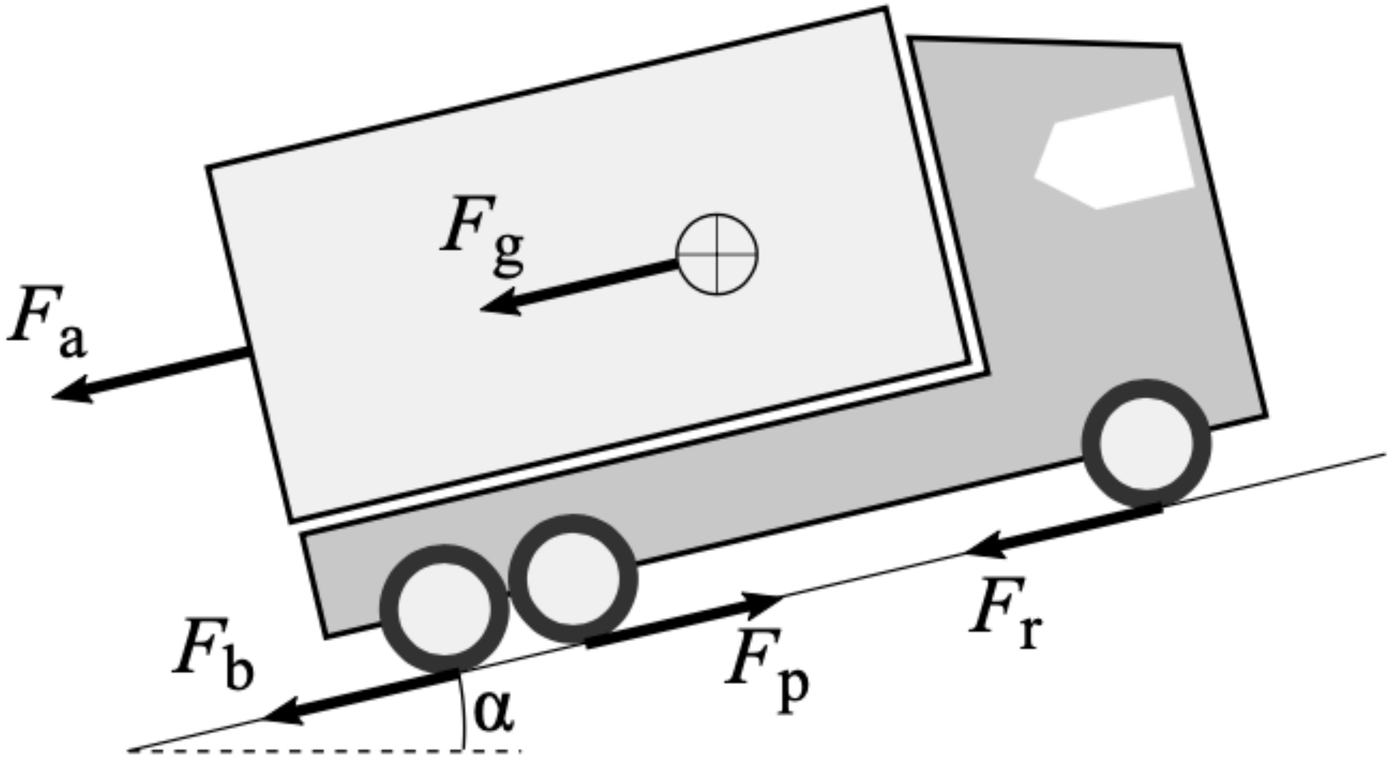
Vehicle models

Platoon models

Cost functions



Vehicle Models



Vehicle Models

$$\mathbf{x}_i = \begin{bmatrix} v_i \\ d_i \\ x_i \end{bmatrix} \qquad \mathbf{x}_i = \begin{bmatrix} v_i \\ \tau_{i,hw} \\ x_i \end{bmatrix}$$

$$v_i = \dot{x}_i$$

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(functions of gear)

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$$F_{i,ext} = -\overbrace{m_i g sin(\alpha(s_i))}^{gravity} - \overbrace{m_i c_r g cos(\alpha(s_i))}^{roll} - \overbrace{\frac{1}{2}\rho A C_D(d_i) v_i^2}^{drag}$$

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$$\underbrace{C_D(d_i) = C_{D_0}\left(1 - \frac{C_{D_1}}{d_i + C_{D_2}}\right)}_{Drag\ reduction}$$

$\rho - air\ density$

$A - vehicle\ cross\text{-}section\ area$

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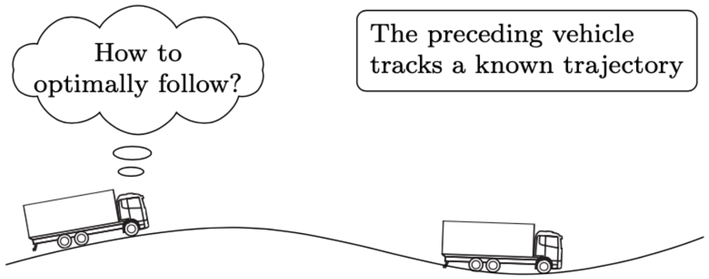
How to get information about preceding vehicle?

Platoon models

Platoon models



Non-cooperative
adaptive look-ahead
(nonlinear model)

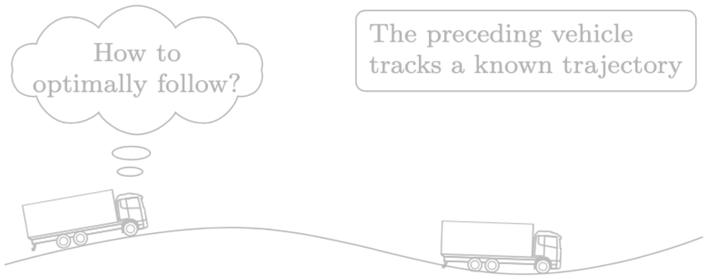
Known trajectory

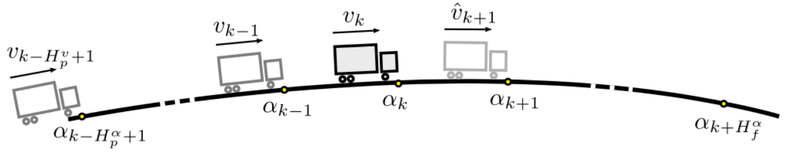
Full communication

DP

Time domain

Platoon models





Non-cooperative
adaptive look-ahead
(nonlinear model)

Known trajectory | Full communication

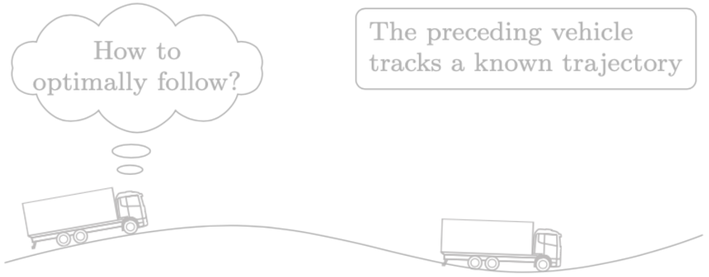
DP | Time domain

Non-cooperative
adaptive predictive look-ahead
(linearised time-varying model)

ANN for prediction | **No communication**

MPC | **Space domain**

Platoon models



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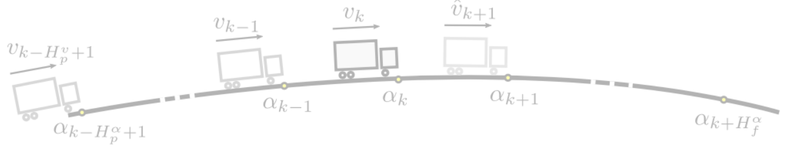

Non-cooperative
adaptive predictive look-ahead
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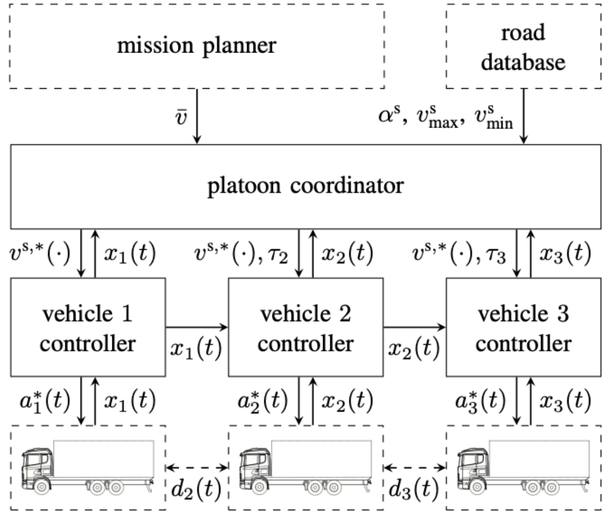


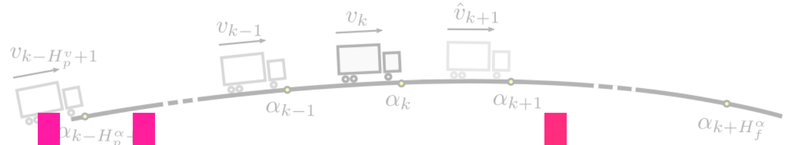
Cooperative
adaptive look-ahead
(nonlinear models)

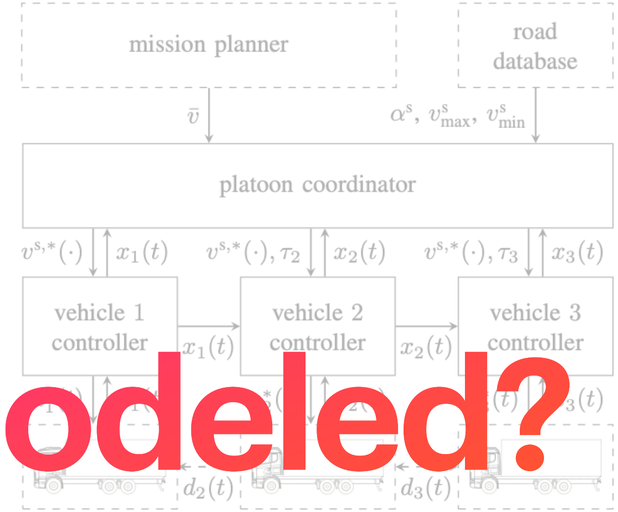
Known trajectory	Full communication
DP	Time domain

ANN for prediction	No communication
MPC	Space domain

DP coordinator	**Full communication**
MPC	**Space domain**

Platoon models

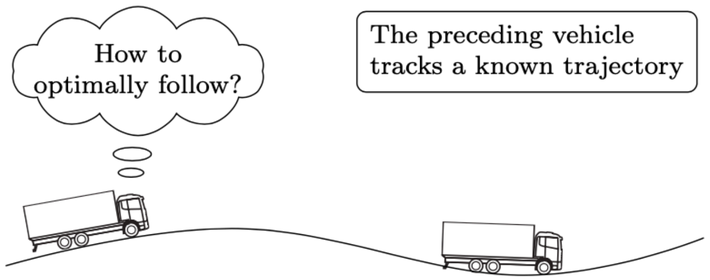




How should ours be modeled?

Non-cooperative adaptive look-ahead (nonlinear model)	Non-cooperative adaptive predictive look-ahead (linearised time-varying model)	Cooperative adaptive look-ahead (nonlinear models)
Known trajectory	ANN for prediction	DP coordinator
Full communication	No communication	Full communication
DP	MPC	MPC
Time domain	Space domain	Space domain

Platoon models



Non-cooperative
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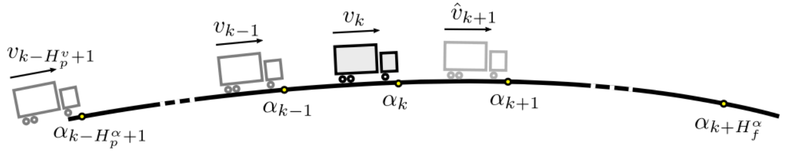

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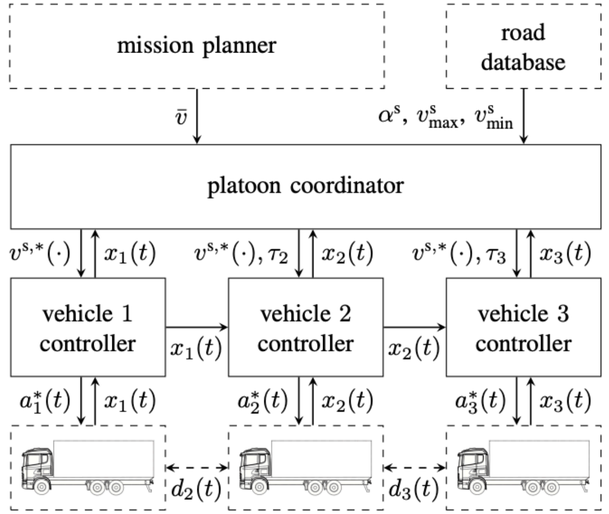

Cooperative
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(nonlinear models)

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Thanks