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1 Notes for the project:

1.1 MPC Control:

I have a state space model for the mpc control used to control the opening of a valve Out variables should control `last_output_velocity`, `last_output_displacement`
How does MPC control work?

$$\dot{x}(t) = Ax(t) + Bu(t) \quad (1)$$

$$y(t) = Cx(t) + Du(t) \quad (2)$$

1.1.1 MPC Control

MPC is based on iterative, finite-horizon optimization of a plant model. At time t the current plant state is sampled and a cost minimizing control strategy is computed (via a numerical minimization algorithm) for a relatively short time horizon in the future: $[t, t + T]$ Model predictive control is a multivariable control algorithm that uses:

- an internal dynamic model of the process
- a cost function J over the receding horizon
- an optimization algorithm minimizing the cost function J using the control input u

1. Equations:

$$n_x = 6, N = 1$$

$$\text{shape}(x) = (6, 1) \text{ shape}(u) = (3, 1)$$

- Variables x, u

- constraints:
 - $x_{k+1} = A_d x_k + B_d u_k$
 - $u_k \geq -10, u_k < 0$

Controlup outputs the predicted control signal $u[:, 0]$

Adapt the control methods to provide the predicted state of the system to the DDPG framework

1.2 DDPG:

Reinforcement learning technique that strives to combine perception capabilities of Deep learning with Decision capabilities of conventional reinforcement learning.

- The perception step that gives information about the environment.
- The decision step that self actualizes to get an appropriate response.

1. How to define agents

- We need to deal with distinct and continuous action spaces
- State spaces:
 - controllerup: $[-10, 0]$
 - controllerdown: $[0, 1]$
 - controllerup: $[0, 250]$

1.3 Data flow:

- MPC: Takes in current state x_k and a target reference
- MPC: outputs predicted state x_{k+1} , predicted control u_{k+1}
- DDPG Takes in predicted state and outputs a control action u_{k+1}
- Why should I Update target reference?