Mini-Projects ARS1

Project 1: Rendez-vous Problem

Suppose the case of six robots, where we can control directly their speed. The objective is to let the robots meet each other.

Proposed initial positions of the robots: (-4, 8); (-3, -4); (3, -1); (6, 3); (2, -5); (3, 7) (could be changed). Suppose that all the robots communicate between themselves:

- Plot the graph of the system
- Propose a consensus-based control law that let the agents meet together
- Implement the controlled system in Matlab/Simulink and analyze the results function of the controllers' gains.
- Propose another simplified graph with less connections, which responds to the Rendez-vous problem; then adapt the proposed controller and analyze the simulation results. Prove the convergence of the system.
- Propose a graph and a controller that let the robots meet at the first robot's position.
- For each case, plot the trajectories of the different agents.

Extra-question: Propose a controller that lets the robots meet, then continue to travel together parallel to the 'y-axis' at constant speed.

Project 2: Rendez-vous Problem with target

Suppose the case of five robots, where we can control directly their speed. The objective is to let the robots meet together in a specified position.

Proposed initial positions of the robots: (0, 8); (-2, -4); (3, -1); (6, 4); (-4, 7) (could be changed). Agents have to meet in the specific location (0, 0).
Suppose that all the robots communicate between themselves:

- Plot the graph of the system
- Propose a consensus-based control law that let the agents meet in the specified location
- Implement the controlled system in Matlab/Simulink and analyze the results function of the controllers' gains.
- Propose another simplified graph with less connections, which responds to the problem; then adapt the proposed controller and analyze the simulation results. Prove the convergence of the system.
- For each case, plot the trajectories of the different agents.

Extra-question: Propose a controller that lets the robots meet, then continue to travel together with respect to the 'x-axis' direction at constant speed.

Project 3: Formation control + destination

Suppose the case of five robots, where we can control directly their speed. The robots have to go to specified locations, while maintaining the shape of the final formation (given by the final destinations).

Proposed initial positions of the robots: (0, 4); (0, 2); (0, 0); (0, -2); (0, -4) (could be changed).
Destinations: (24, 2); (27, 1); (30, 0); (27, -1); (24, -2)
Suppose that all the robots communicate between themselves:

- Plot the graph of the system
- Propose a consensus-based control law that ensures the control objective
- Implement the controlled system in Matlab/Simulink and analyze the results function of the controllers' gains.
- Propose another simplified graph with less connections, which responds to the problem; then adapt the proposed controller and analyze the simulation results. Prove the convergence of the system.
- Test the proposed controller when the destinations are respectively: (24, -2); (27, -1); (30, 0); (27, 1); (24, 2). Analyze the results.
- For each case, plot the trajectories of the different agents.

Extra question: Propose a controller that forms the shape of the formation, then the robots continue to travel with the same formation, parallel to the 'x-axis' direction at constant speed.

Project 4: Platooning - Consensus

Suppose the case of five robots, where we can control directly their speed. The agents should maintain a linear formation.

Proposed initial positions of the robots: (0, 1.5), (0, -1.5); (-3, 3); (-3, 0); (-3, -3) (could be changed).
Destinations: (34, 0); (31, 0); (28, 0); (25, 0); (22, 0).
Suppose that all the robots communicate between themselves:

- Plot the graph of the system
- Propose a consensus-based control law that ensures the control objective
- Implement the controlled system in Matlab/Simulink and analyze the results function of the controllers' gains.
- Propose another simplified graph with less connections, which responds to the problem; then adapt the proposed controller and analyze the simulation results. Prove the convergence of the system.
- Test the proposed controller when the destinations are respectively: (22, 0); (28, 0); (31, 0); (34, 0); (25, 0). Analyze the results.
- For each case, plot the trajectories of the different agents.

Extra question: Propose a controller that forms the platoon, then the robots continue to travel in platooning, on the 'x-axis' at constant speed.