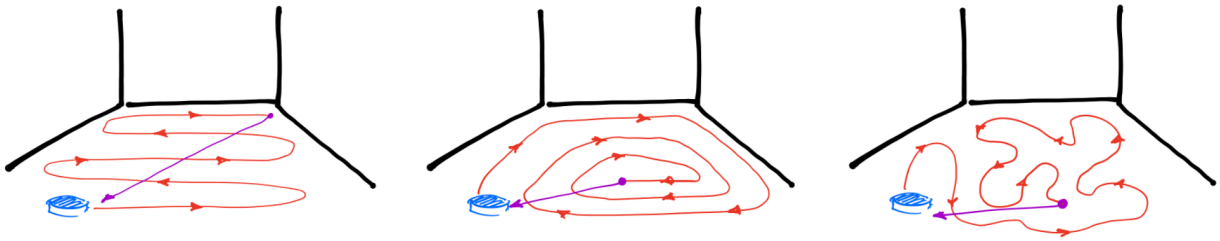
Laboratory work: the "roomba challenge"

Problem: *A simple mobile robot has to navigate a room environment for a cleaning task and come back to the docking station to recharge*

Scenario and tasks

You will have to deal with the control of a unicycle robot in a room, with:

- **Phase 1:** path tracking task starting from the docking station position.
- **Phase 2:** parking task to the docking station.



Methodologies

Tracking control:

1. linearization of the state error dynamics;
2. non-linear controller of the state error dynamics;
3. feedback linearization based on a reference point on the sagittal axis;
4. feedback linearization based on second order derivatives.

Regulation:

1. Cartesian regulation;
2. posture regulation scheme (with singularity at the origin);
3. posture regulation scheme (without singularity at the origin).

Assignment:

Choose one scenario environment and the methodologies you want to explore; develop the following:

- Definition: environment - a (simple) path - performance indexes.
- Realization of the tracking/regulation control schemes.
- Results/performance analysis and discussion.

Other main issues that may be studied:

- Analysis with different initial conditions - controller gains - ...
- Method comparison.