

Assignment

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Overview

%% From Piazza, the professor said the model in the reference chapter is also acceptable

%% To make my life easier, I directly use the model of the reference Chapter 3

%% Where: Inputs: v , δ ; Outputs: x , y , θ

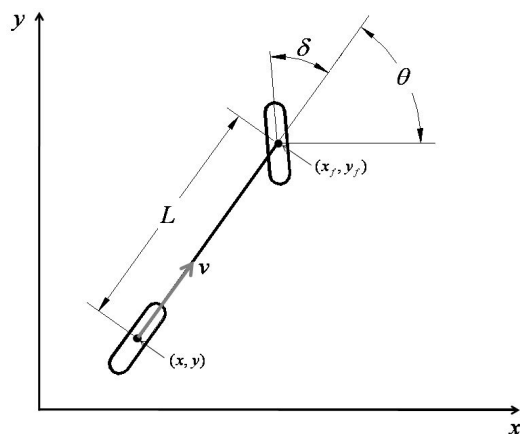
Reference:

1. Chap 3 - Automatic_Steering_Methods_for_Autonomous_Automobile_Path_Tracking
2. Chap 3.6 - Roland Siegwart - Autonomous Mobile Robots

Explanation

1. **System Model:** Controller Output: (v, δ) ; System State Outputs: (x, y, θ) ;

Goal : $(x, y, \theta) = (0, 0, \pi/2)$



2. Contrller:

$$v = K_{\rho} * \sqrt{x_{\text{error}} * x_{\text{error}} + y_{\text{error}} * y_{\text{error}}};$$

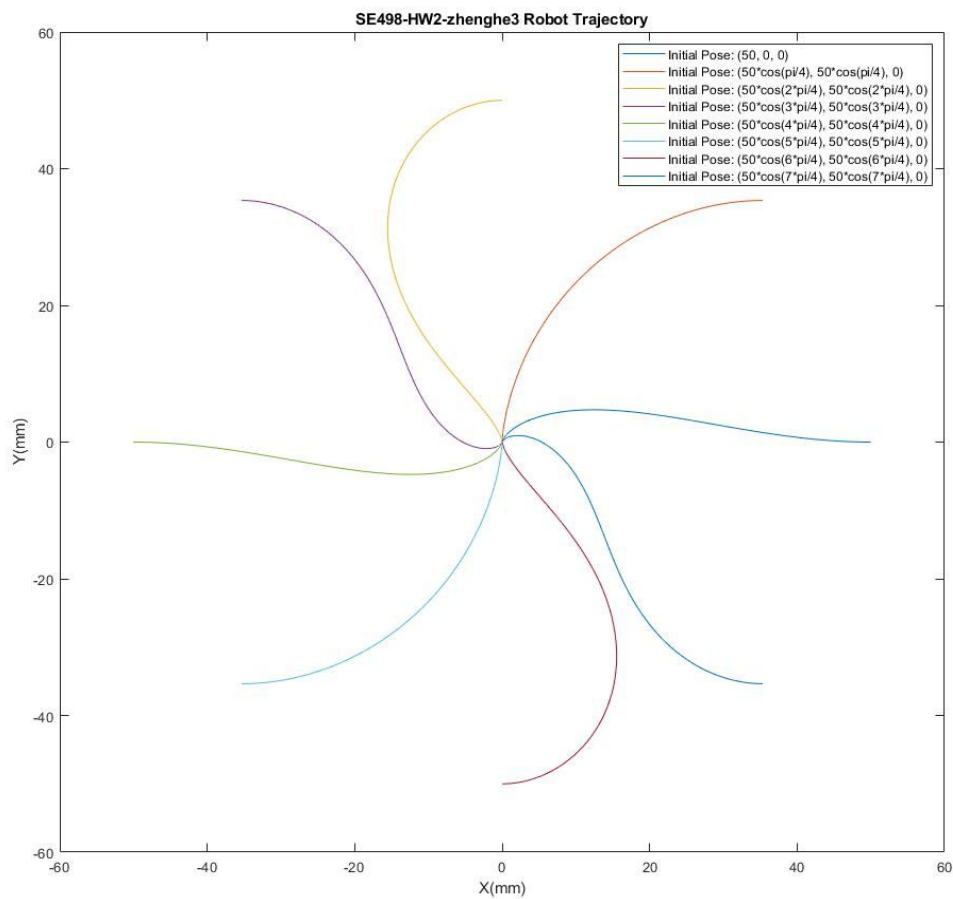
$$\delta = \arctan(\text{forward_mode} * (K_{\alpha} * \alpha + K_{\beta} * \beta) * L / v);$$

Where:

$$K_{\rho} = 8; K_{\alpha} = -1.5; K_{\beta} = 3;$$

forward_mode = 1 or -1 decided by the initial pose and relative position of the goal

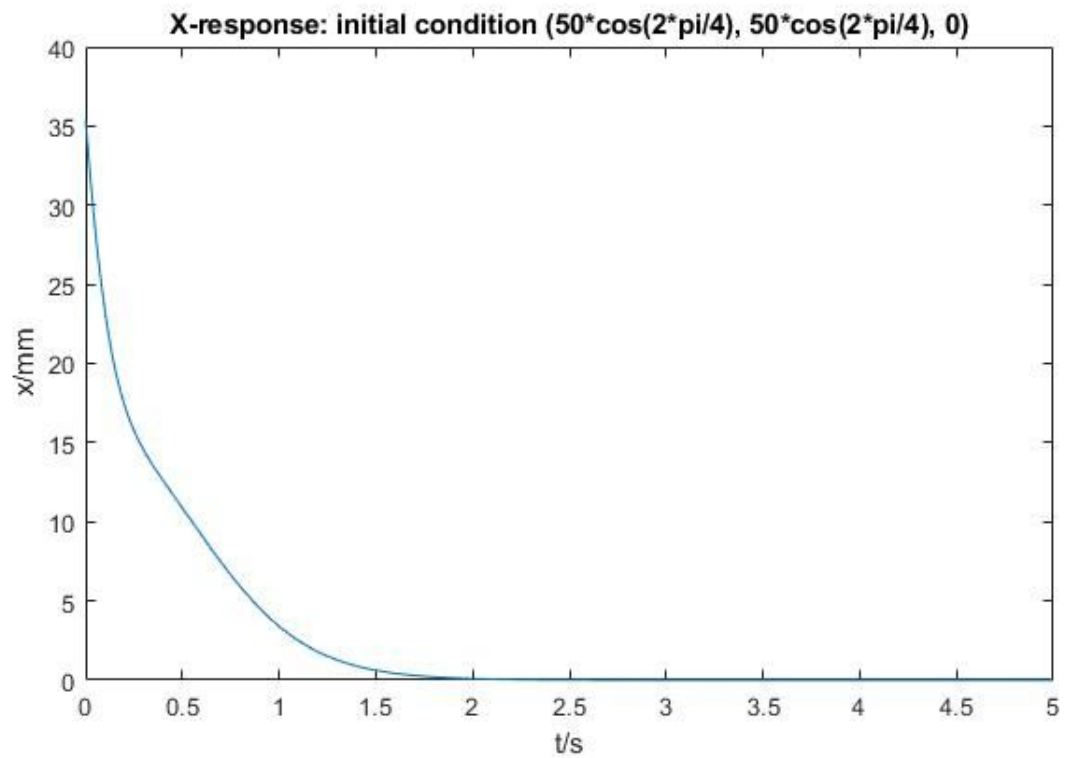
Final Plot: (see the original figure in my submitted folder)

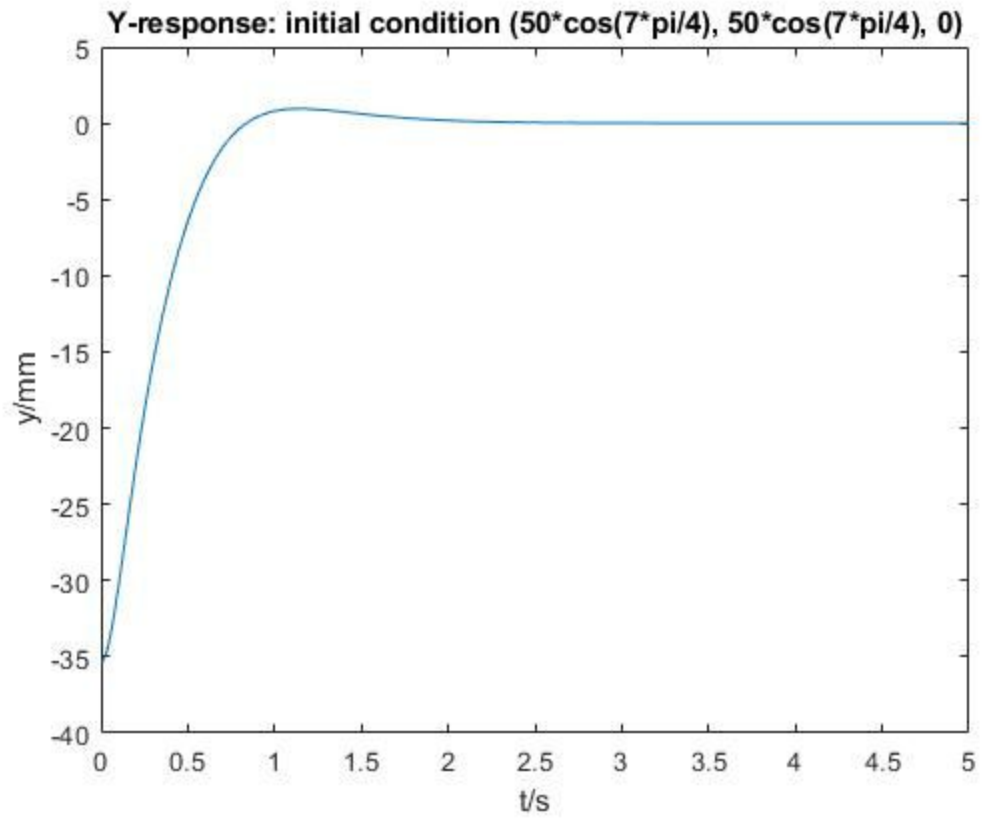


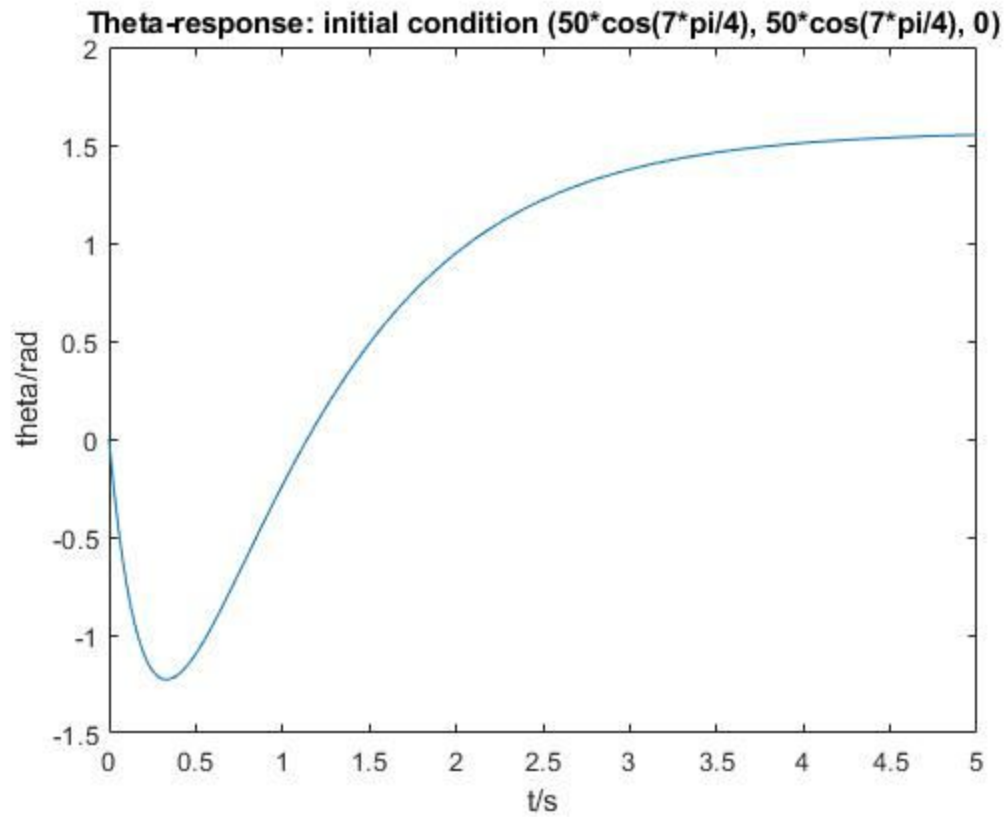
Conclusion

1. Convergence to the goal:

The result shows: With my controller, the robot can converge to the goal within 5 seconds, and the pose error is relatively small, let's take the simulation with initial pose $(50 \cdot \cos(7 \cdot \pi/4), 50 \cdot \cos(7 \cdot \pi/4), 0)$ as an example:







2. Robust against most initial condition

As you can see in my final result plot, it is robust to all the initial positions.