R101/R102 演習 3-4

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知的システム工学科システム制御コース

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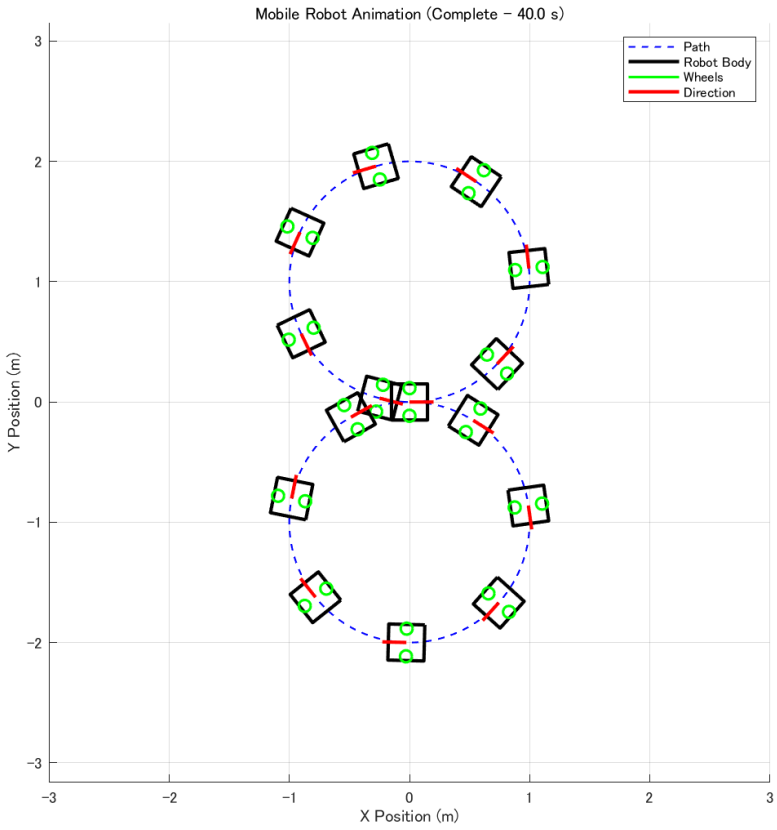
Listing 1: modified __ mobile __ robot __ controller.m

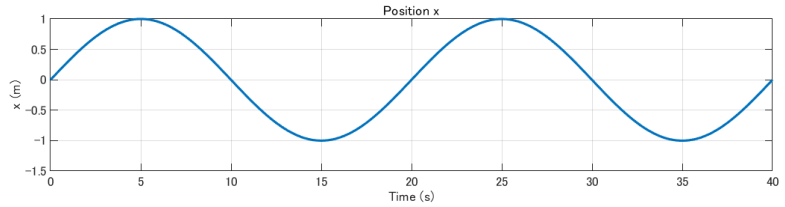
```
1
2  function [dphi_l, dphi_r] = mobile_robot_controller(t, x, params)
3  % Mobile robot controller - calculates wheel angular velocities directly
4  % Inputs:
5  %   t - current time [s]
6  %   x - state vector [x_position; y_position; theta_orientation]
7  %   params - structure containing robot parameters
8  % Outputs:
9  %   dphi_l - left wheel angular velocity [rad/s]
10 %   dphi_r - right wheel angular velocity [rad/s]
11
12 % Extract state
13 xc = x(1);      % x-position [m]
14 yc = x(2);      % y-position [m]
15 theta = x(3);   % orientation [rad]
16
17 % Extract robot parameters
18 r = params.wheel_radius;
19 d = params.wheel_distance;
20
21 % Calculate wheel velocities based on selected motion type
22 switch params.motion_type
23     case 1
24         % Exercise 1: Constant wheel velocities - already using wheel
   ↪ velocities
25         dphi_l = params.ex1.left_wheel_vel;
26         dphi_r = params.ex1.right_wheel_vel;
27
28     case 2
29         % Exercise 2: Circular motion
30         T = params.ex2.period;
31         R = params.ex2.radius;
32
33         % Calculate desired linear and angular velocity
34         % TODO: Fix this
35         v = 2 * pi * R / T;
36         omega = v / R;
37
38         % Convert to wheel velocities
39         % TODO: Fix this
40         dphi_l = (v - (d/2)*omega) / r;
41         dphi_r = (v + (d/2)*omega) / r;
42
43     case 3
44         % Exercise 3: Figure-8 motion
45         T = params.ex3.period;
```

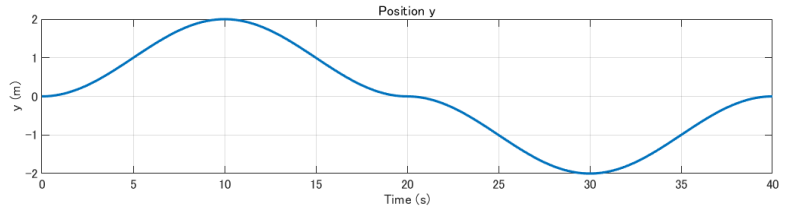
```
        R = params.ex3.radius;

        % Calculate desired linear velocity
        % TODO: Fix this
        v = (2*pi*R)/T;

        % Angular velocity depends on time
        % TODO: Fix this
        if mod(t, 2*T) < T
            omega = v/R;
        else
            omega = -v/R;
        end

        % Convert to wheel velocities
        % TODO: Fix this
        dphi_l = (v - (d/2)*omega) / r;
        dphi_r = (v + (d/2)*omega) / r;

    case 4
        % Exercise 4: Square path
        T = params.ex4.period;
        D = params.ex4.side_length;

        % Time periods
        Tt = T * 0.7;  % translation period
        Tr = T - Tt;   % rotation period

        % Velocities
        % TODO: Fix this
        v_max = 0.0;
        omega_max = 0.0;

        % Calculate phase in the square trajectory (4 sides)
        cycle_time = mod(t, 4*T);
        phase = floor(cycle_time / T);
        segment_time = mod(cycle_time, T);

        % Set linear and angular velocities based on phase
        % TODO: Fix this
        if segment_time < Tt
            v = 0.0;
            omega = 0.0;
        else
            v = 0.0;
            omega = 0.0;
        end
```

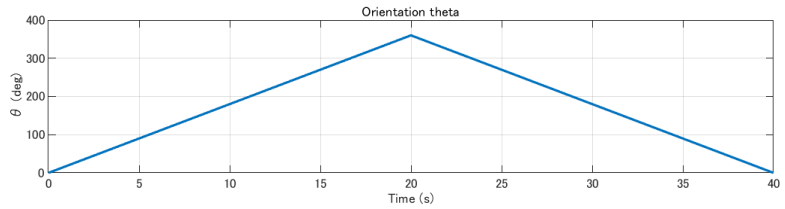
```
93
94          % Convert to wheel velocities
95          % TODO: Fix this
96          dphi_l = 0.0;
97          dphi_r = 0.0;
98
99      otherwise
100         warning('Unknown motion type: %d. Using default (straight line).',
    ↪ params.motion_type);
101         v = 0.5;  % Default linear velocity [m/s]
102         omega = 0;  % Default angular velocity [rad/s]
103
104         % Convert to wheel velocities
105         % TODO: Fix this
106         dphi_l = 0.0;
107         dphi_r = 0.0;
108 end
109
110 end
```

上記に示すプログラムの通り、case3 の箇所を修正しシミュレーションできるように調整した。
そして、シミュレーションした結果を次に示す。









1　参考文献

- テキスト（第 3 章）