

R101/R102 演習 3-5

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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
25         ↪ velocities
26         dphi_l = params.ex1.left_wheel_vel;
27         dphi_r = params.ex1.right_wheel_vel;
28
29     case 2
30         % Exercise 2: Circular motion
31         T = params.ex2.period;
32         R = params.ex2.radius;
33
34         % Calculate desired linear and angular velocity
35         % TODO: Fix this
36         v = 2 * pi * R / T;
37         omega = v / R;
38
39         % Convert to wheel velocities
40         % TODO: Fix this
41         dphi_l = (v - (d/2)*omega) / r;
42         dphi_r = (v + (d/2)*omega) / r;
43
44     case 3
45         % Exercise 3: Figure-8 motion
46         T = params.ex3.period;

```

```

46     R = params.ex3.radius;
47
48     % Calculate desired linear velocity
49     % TODO: Fix this
50     v = (2*pi*R)/T;
51
52     % Angular velocity depends on time
53     % TODO: Fix this
54     if mod(t, 2*T) < T
55         omega = v/R;
56     else
57         omega = -v/R;
58     end
59
60     % Convert to wheel velocities
61     % TODO: Fix this
62     dphi_l = (v - (d/2)*omega) / r;
63     dphi_r = (v + (d/2)*omega) / r;
64
65 case 4
66     % Exercise 4: Square path
67     T = params.ex4.period;
68     D = params.ex4.side_length;
69
70     % Time periods
71     Tt = T * 0.7; % translation period
72     Tr = T - Tt; % rotation period
73
74     % Velocities
75     % TODO: Fix this
76     v_max = D/Tt;
77     omega_max = (pi/2)/Tr;
78
79     % Calculate phase in the square trajectory (4 sides)
80     cycle_time = mod(t, 4*T);
81     phase = floor(cycle_time / T);
82     segment_time = mod(cycle_time, T);
83
84     % Set linear and angular velocities based on phase
85     % TODO: Fix this
86     if segment_time < Tt
87         v = v_max;
88         omega = 0;
89     else
90         v = 0;
91         omega = omega_max;
92     end

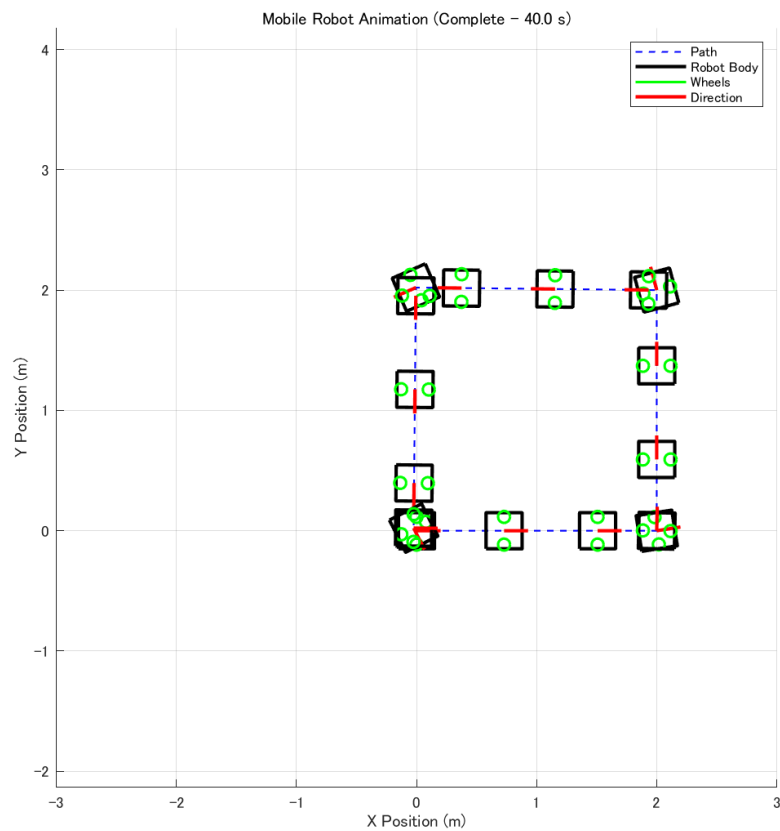
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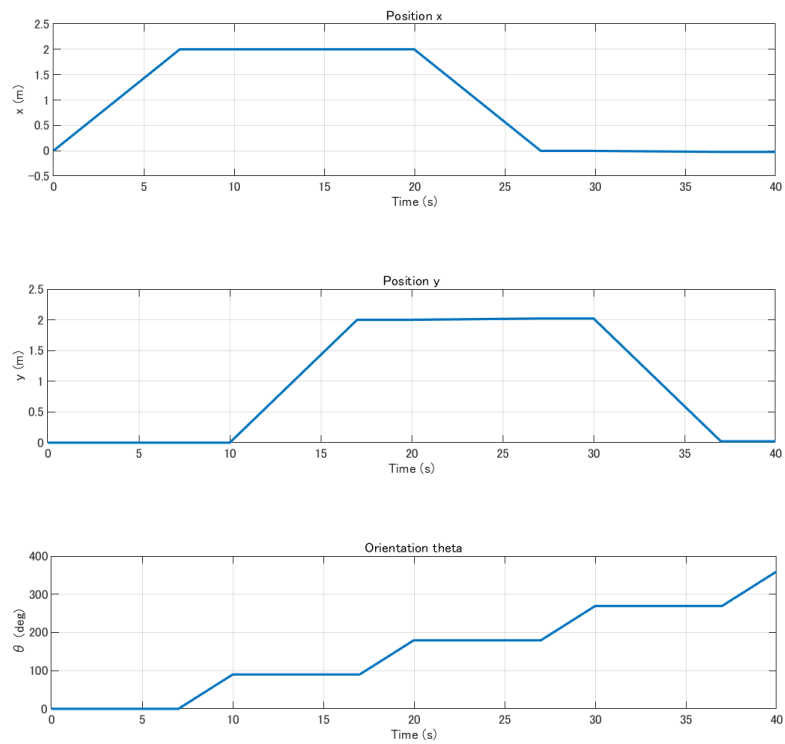
```

93
94     % Convert to wheel velocities
95     % TODO: Fix this
96     dphi_l = (v - (d/2)*omega) / r;
97     dphi_r = (v + (d/2)*omega) / r;
98
99     otherwise
100         warning('Unknown motion type: %d. Using default (straight line).',
101 ↪ params.motion_type);
102         v = 0.5; % Default linear velocity [m/s]
103         omega = 0; % Default angular velocity [rad/s]
104
105         % Convert to wheel velocities
106         % TODO: Fix this
107         dphi_l = (v - (d/2)*omega) / r;
108         dphi_r = (v + (d/2)*omega) / r;
109
110     end
111 end

```

上記に示すプログラムの通り、case4 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)