# R101/R102 演習 3-2

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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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# 1 演習 3-2

## 1.1 listing3.1 の確認

Listing 1.1: Listing3.1 の確認

```
1
2  % mobile_robot_params.m
3  % Configuration parameters for mobile robot simulation
4
5  % Robot physical parameters - fixed, not intended to be changed
6  params.wheel_radius = 0.05;  % radius of wheel [m]
7  params.wheel_distance = 0.23;  % distance between wheels [m]
8  params.body_length = 0.3;    % length of robot body [m]
9  params.body_width = 0.3;     % width of robot body [m]
10
11 % Simulation parameters
12 params.sim_time = 40;         % simulation time [s]
13 params.ode_max_step = 1e-1;  % maximum step size for ODE solver
14
15 % Animation parameters
16 params.draw_mode = 1;         % 0: update existing plot, 1: create new plot
       ↪ each frame
17 params.ani_sample = 100;     % animation sampling rate (higher = slower
       ↪ animation)
18 params.field_size = 3;       % size of the field for visualization [m]
19
20 % Motion parameters - different exercises
21 % Exercise 1: Constant wheel velocities
22 ex1.left_wheel_vel = 1.0;   % left wheel angular velocity [rad/s]
23 ex1.right_wheel_vel = 1.0;  % right wheel angular velocity [rad/s]
24
25 % Exercise 2: Circular motion
26 ex2.period = 40;            % period [s]
27 ex2.radius = 1.0;           % radius of rotation [m]
28
29 % Exercise 3: Figure-8 motion
30 ex3.period = 20;            % period for half of figure-8 [s]
31 ex3.radius = 1.0;           % radius of rotation [m]
32
```

```
% Exercise 4: Square path
ex4.period = 10;            % period for each segment [s]
ex4.side_length = 2.0;      % length of one side of square [m]

% Motion type selection (1, 2, 3, or 4)
% Change this value to select different motion types:
% 1: Constant Wheel Velocities
% 2: Circular Motion
% 3: Figure-8 Motion
% 4: Square Path
params.motion_type = 1;

% Combine all exercise parameters
params.ex1 = ex1;
params.ex2 = ex2;
params.ex3 = ex3;
params.ex4 = ex4;
```

上記ソースコードより、すでに用意されていた Listing3.1 のファイルを開いて params.motion __ type が 1 で初期化されていることを確認した。

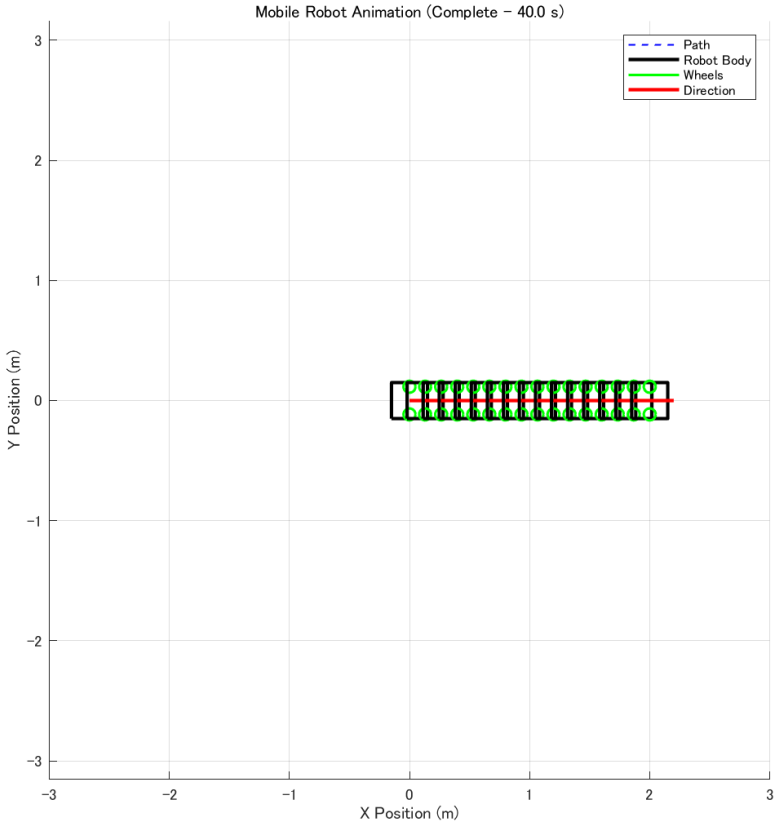
## 1.2 プログラムの修正

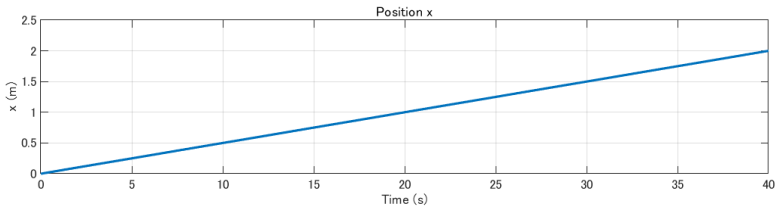
テキスト（第 3 章）中に指示された箇所を修正して状態方程式を追加した。シミュレーションの画像とグラフを出力した。

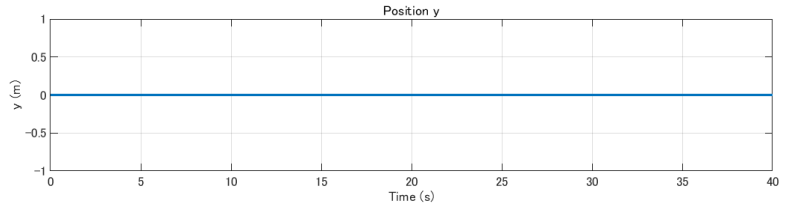
Listing 1.2: modified __ dynamics __ mobile __ robot.m

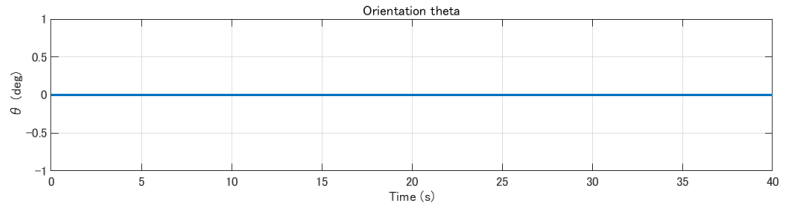
```

function [dxdt, wheel_vel] = dynamics_mobile_robot(t, x, params)
% Dynamics of mobile robot
% Inputs:
%   t - current time [s]
%   x - state vector [x_position; y_position; theta_orientation]
%   params - structure containing robot parameters
% Outputs:
%   dxdt - time derivative of state vector
%   wheel_vel - [left_wheel_velocity, right_wheel_velocity]

% Extract state
xc = x(1);      % x-position [m]
yc = x(2);      % y-position [m]
theta = x(3);   % orientation [rad]

% Extract robot parameters
r = params.wheel_radius;     % radius of wheel [m]
d = params.wheel_distance;   % distance between wheels [m]

```

```
% Get wheel velocities directly from the controller
[dphi_l, dphi_r] = mobile_robot_controller(t, x, params);
v = (r/2)*(dphi_l + dphi_r);
omega = (r/d)*(dphi_r - dphi_l);
% State equations
% TODO: Fix this
dx1dt = v * cos(theta);
dx2dt = v * sin(theta);
dx3dt = omega;

% Output
dxdt = [dx1dt; dx2dt; dx3dt];
wheel_vel = [dphi_l, dphi_r];
end
```






# 2　参考文献

- テキスト（第 3 章）