```
clc;

simulation_time_start = 1; % [sec]
simulation_time_end = 12; % [sec]
simulation_time_step = 0.0001; % [sec]
K_u = 1.2; % [-]
R_a = 2.2; % [ohm]
K_m = 24e-3; % [N*m/A]
J = 0.005; % [kg*m^2]
K_b = 0.024; % [V*s/rad]
L_a = 0.26e-3; % [H]
b = 0.0043; % [kg*m^2/rad*s]
N_r = 4.9;
T_d = 0; % [N*m]
u = 7; % [V]
K_p = 1;
theta_ref = pi/4; % [rad]

sim('simulation.slx');

%%

theta_t = ans.theta.time;
theta_values = ans.theta.signals.values;

fig1 = figure ("Name","θ - Step Response for u(t) = 7*1(t); Td(t) = 0",'Position',[100 350 900 500]);
hold all
grid on
grid minor

plot(theta_t, theta_values ,'LineWidth',2,'Color',"#7E2F8E")

title ("θ - Step Response for u(t) = 7*1(t); Td(t) = 0");
```

```
 34 subtitle("Almog Dobrescu 214254252")
 35 ylabel("θ(t) [rad]")
 36 xlabel("t [sec]")
 37 grid on
 38 grid minor
 39 legend({'Step Response for u(t) = 7*1(t); Td(t) =↙
0'},'FontSize',11 ,'Location','southeast')
 40 %exportgraphics(fig1, '2.1grap1.png','Resolution',1200);
 41
 42 %%
 43
 44 omega_t = ans.omega.time;
 45 omega_values = ans.omega.signals.values;
 46
 47 fig2 = figure ("Name","ω - Step Response for u(t) = 7*1↙
(t); Td(t) = 0",'Position',[400 350 900 500]);
 48 hold all
 49 grid on
 50 grid minor
 51
 52 plot(omega_t, omega_values ,'LineWidth',2,'Color',"↙
#7E2F8E")
 53
 54 title ("ω - Step Response for u(t) = 7*1(t); Td(t) = 0");
 55 subtitle("Almog Dobrescu 214254252")
 56 ylabel("ω(t) [rad]")
 57 xlabel("t [sec]")
 58 grid on
 59 grid minor
 60 legend({'Step Response for u(t) = 7*1(t); Td(t) =↙
0'},'FontSize',11 ,'Location','southeast')
 61 %exportgraphics(fig2, '2.1grap2.png','Resolution',1200);
 62
 63 %%
 64
```

```
 65 omega_over_u_roots = roots([J*L_a J*R_a+b*L_a↙
R_a*b+N_r^2*K_m*K_b]);
 66
 67 %% Q.2.2
 68 K_p = 1;
 69 sim('simulation.slx');
 70
 71 theta_t = ans.theta.time;
 72 theta_values = ans.theta.signals.values;
 73
 74 fig3 = figure ("Name","θ - Step Response for θref(t) =↙
π/4*1(t); Td(t) = 0; kp = 1",'Position',[700 350 900 500]);
 75 hold all
 76 grid on
 77 grid minor
 78
 79 plot(theta_t, theta_values ,'LineWidth',2,'Color',"↙
#7E2F8E")
 80 %plot(theta_t, ones(length(theta_t),1).*↙
(pi/4),'LineWidth',1,'Color',"#A2142F");
 81
 82 title ("θ - Step Response for θref(t) = π/4*1(t); Td(t) =↙
0; kp = 1");
 83 subtitle("Almog Dobrescu 214254252")
 84 ylabel("θ(t) [rad]")
 85 xlabel("t [sec]")
 86 grid on
 87 grid minor
 88 legend({'Step Response for θref(t) = π/4*1(t); Td(t) = 0;↙
kp = 1','π/4'},'FontSize',11 ,'Location','southeast')
 89 %exportgraphics(fig3, '2.2grap1.png','Resolution',1200);
 90
 91 %%
 92
 93 K_p = 0.5;
```

```
 94 sim('simulation.slx');
 95
 96 theta_t = ans.theta.time;
 97 theta_values = ans.theta.signals.values;
 98
 99 fig4 = figure ("Name","θ - Step Response for θref(t) =↙
π/4*1(t); Td(t) = 0; kp = 0.5",'Position',[100 150 900 500]);
100 hold all
101 grid on
102 grid minor
103
104 plot(theta_t, theta_values ,'LineWidth',2,'Color',"↙
#7E2F8E")
105 %plot(theta_t, ones(length(theta_t),1).*↙
(pi/4),'LineWidth',1,'Color',"#A2142F");
106
107 title ("θ - Step Response for θref(t) = π/4*1(t); Td(t) =↙
0; kp = 0.5");
108 subtitle("Almog Dobrescu 214254252")
109 ylabel("θ(t) [rad]")
110 xlabel("t [sec]")
111 grid on
112 grid minor
113 legend({'Step Response for θref(t) = π/4*1(t); Td(t) = 0;↙
kp = 0.5','π/4'},'FontSize',11 ,'Location','southeast')
114 %exportgraphics(fig4, '2.2grap2.png','Resolution',1200);
115
116 %%
117 clc;
118 format long
119
120 temp = figure;
121 max_num = 0.44;
122 min_num = 0.415;
123 step_size = 0.0001;
```

```
124 K_p_s = min_num:step_size:max_num;
125 num_of_interation = (max_num - min_num)/step_size + 1
126 for index = 1:num_of_interation
127     %disp(K_p_s(index));
128     K_p = K_p_s(index);
129     sim('simulation.slx');
130     theta_values = ans.theta.signals.values;
131     theta_t = ans.theta.time;
132     M_p = (max(theta_values) - pi/4)/(pi/4)
133     plot(theta_t, theta_values)
134     if M_p >= 0.2
135         my_K_p = K_p_s(index);
136         disp("kp is: " + my_K_p);
137         break
138     end
139 end
140
141 %%
142
143 K_p = my_K_p;
144
145 sim('simulation.slx');
146
147 u_t = ans.u.time;
148 u_values = ans.u.signals.values;
149
150 fig5 = figure ("Name","u - Step Response for θref(t) =↙
π/4*1(t); Td(t) = 0; kp = 0.4201",'Position',[400 150 900↙
500]);
151 hold all
152 grid on
153 grid minor
154
155 plot(u_t, u_values ,'LineWidth',2,'Color',"#7E2F8E")
156
```

```
157 title ("u - Step Response for θref(t) = π/4*1(t); Td(t) =↙
0; kp = 0.4201");
158 subtitle("Almog Dobrescu 214254252")
159 ylabel("u(t) [rad]")
160 xlabel("t [sec]")
161 grid on
162 grid minor
163 legend({'Step Response for θref(t) = π/4*1(t); Td(t) = 0;↙
kp = 0.4201'},'FontSize',11 ,'Location','southeast')
164 %exportgraphics(fig5, '2.2grap3.png','Resolution',1200);
165
166 theta_t = ans.theta.time;
167 theta_values = ans.theta.signals.values;
168
169 fig6 = figure ("Name","θ - Step Response for θref(t) =↙
π/4*1(t); Td(t) = 0; kp = 0.4201",'Position',[700 150 900↙
500]);
170 hold all
171 grid on
172 grid minor
173
174 plot(theta_t, theta_values ,'LineWidth',2,'Color',"↙
#7E2F8E")
175
176 title ("θ - Step Response for θref(t) = π/4*1(t); Td(t) =↙
0; kp = 0.4201");
177 subtitle("Almog Dobrescu 214254252")
178 ylabel("θ(t) [rad]")
179 xlabel("t [sec]")
180 grid on
181 grid minor
182 legend({'Step Response for θref(t) = π/4*1(t); Td(t) = 0;↙
kp = 0.4201'},'FontSize',11 ,'Location','southeast')
183 %exportgraphics(fig6, '2.2grap4.png','Resolution',1200);
184
```

185