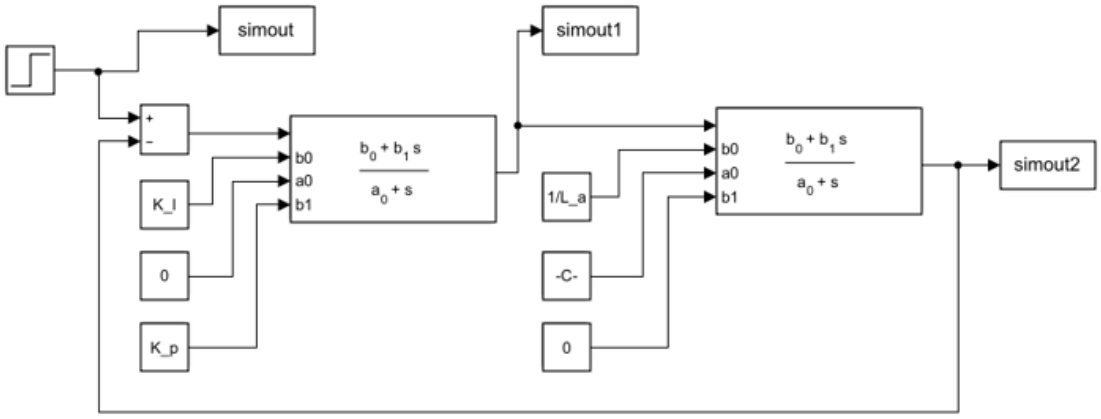
```
clear all;
% Spencer Goulette
% 02/04/20
```

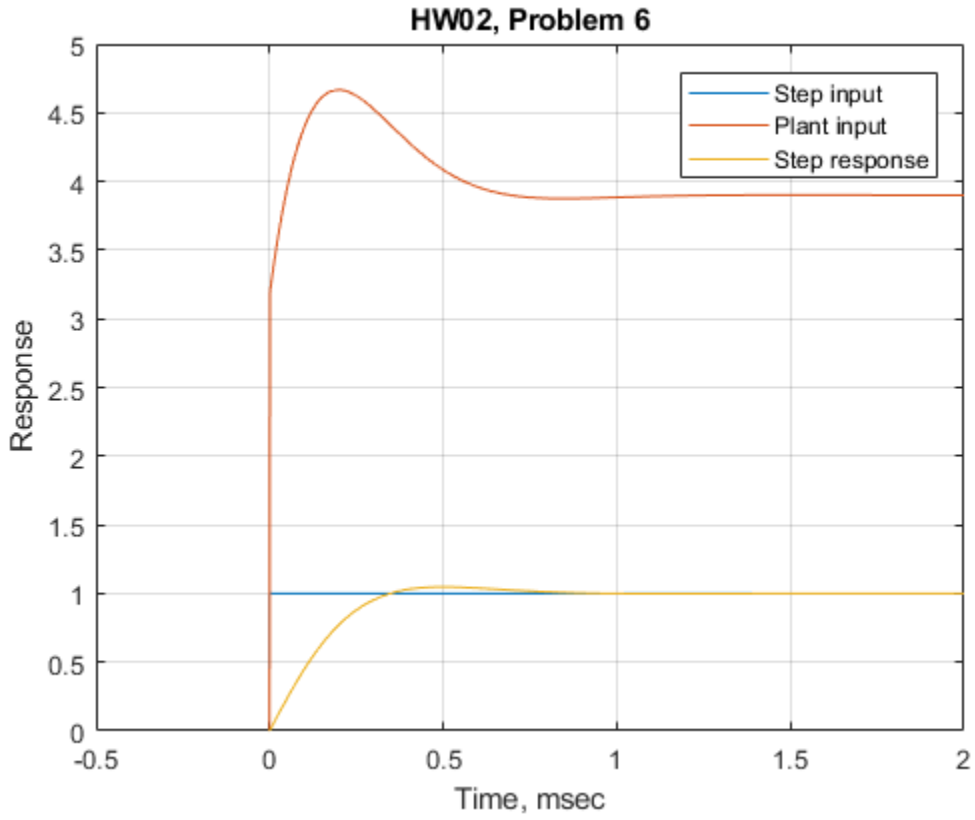
Problem 6

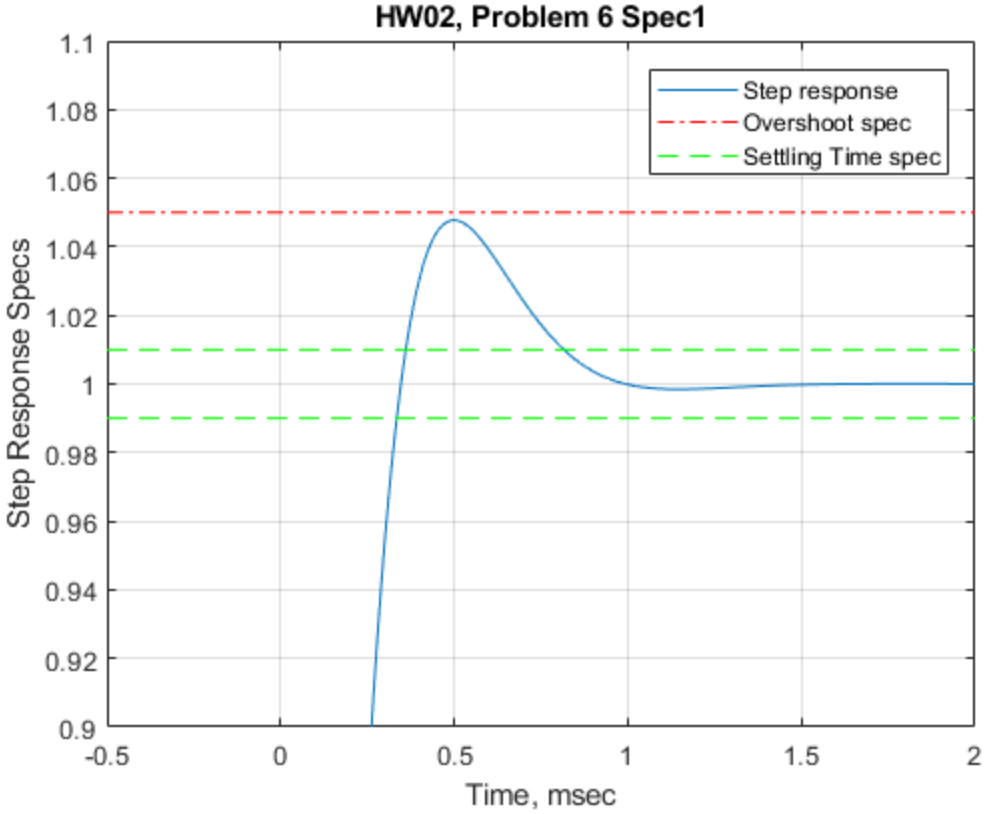
```
R_a = 3.9;      % resistance
L_a = .665e-3;  % inductance
K_p = 3.17125;  % control parameters
K_l = 34473.6;

% Simulink
out = sim('ECE414HW2_6',...
          'StartTime', '-.1e-6',...
          'StopTime', '2e-3',...
          'MaxStep', '1e-9');

open_system('ECE414HW2_6');

% Get Simulink data for input, plant input, and output
data = out.get('simout');
t = data.Time;
r = data.Data;

data1 = out.get('simout1');
t1 = data1.Time;
r1 = data1.Data;

data2 = out.get('simout2');
t2 = data2.Time;
r2 = data2.Data;

% Plot All Simulink Data
figure(1);
plot(t/1e-3,r,t1/1e-3,r1,t2/1e-3,r2);
grid on;
title("HW02, Problem 6");
xlabel("Time, msec");
ylabel("Response");
legend("Step input","Plant input","Step response");

% Plot step response and horizontal specs
figure(2);
plot(t2/1e-3,r2,[-0.5,2],[1.05,1.05], '-.r',[-0.5,2],[1.01,1.01], '--
g',[-0.5,2],[0.99,0.99], '--g');
grid on;
ylim([0.9 1.1]);
title("HW02, Problem 6 Spec1");
xlabel("Time, msec");
ylabel("Step Response Specs");
legend("Step response","Overshoot spec","Settling Time spec")
```

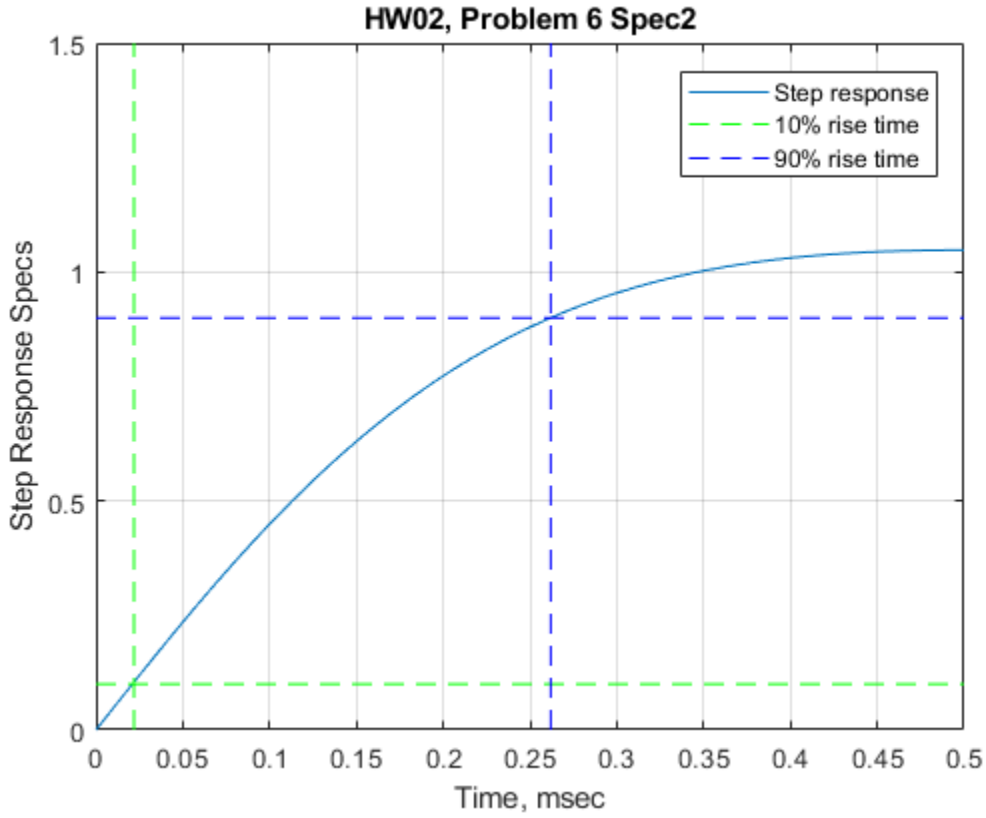
```
% Plot step response and vertical specs
figure(3);
plot(t2/1e-3,r2,[-0.5,2],[0.1,0.1], '--g',[-0.5,2],[0.9,0.9], '--b',
[.0219,.0219],[0,1.5], '--g',[.262,.262],[0,1.5], '--b');
grid on;
xlim([0 0.5]);
title("HW02, Problem 6 Spec2");
xlabel("Time, msec");
ylabel("Step Response Specs");
legend("Step response","10% rise time","90% rise time")
```

```
Warning: Block diagram '<a href="matlab:open_system
('ECE414HW2_6')">ECE414HW2_6</a>' contains 1 algebraic loop(s). To see
 more
details about the loops use the command <a
href="matlab:Simulink.BlockDiagram.getAlgebraicLoops(bdroot);">Simulink.BlockDiagr
href="matlab:open_system ('ECE414HW2_6')">ECE414HW2_6</a>') </a> or
 the command
line Simulink debugger by typing <a
 href="matlab:sldebug(bdroot);">sldebug('<a
href="matlab:open_system ('ECE414HW2_6')">ECE414HW2_6</a>') </a> in
 the MATLAB
command window. To eliminate this message, set <sldiag
 objui="configset"
objparam="AlgebraicLoopMsg">Algebraic loop</sldiag> to "none".
Found algebraic loop containing:

'<a href="matlab:open_and_hilite_hyperlink ('ECE414HW2_6/Varying
 Transfer Function1/Sum1','error')">ECE414HW2_6/Varying Transfer
 Function1/Sum1</a>'

'<a href="matlab:open_and_hilite_hyperlink ('ECE414HW2_6/
Subtract','error')">ECE414HW2_6/Subtract</a>'

'<a href="matlab:open_and_hilite_hyperlink ('ECE414HW2_6/Varying
 Transfer Function/Product1','error')">ECE414HW2_6/Varying Transfer
 Function/Product1</a>'

'<a href="matlab:open_and_hilite_hyperlink ('ECE414HW2_6/Varying
 Transfer Function/Sum1','error')">ECE414HW2_6/Varying Transfer
 Function/Sum1</a>'

'<a href="matlab:open_and_hilite_hyperlink ('ECE414HW2_6/Varying
 Transfer Function1/Product1','error')">ECE414HW2_6/Varying Transfer
 Function1/Product1</a>' (algebraic variable)
```


simout
simout1
simout2
+
-
K_I
0
K_p
b0
a0
b1
$\frac{b_0 + b_1 s}{a_0 + s}$
1/L_a
-C-
0


HW02, Problem 6
Step input
Plant input
Step response
Response
Time, msec
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
0
0.5
1
1.5
2


HW02, Problem 6 Spec1
Step response
Overshoot spec
Settling Time spec
Step Response Specs
Time, msec
1.1
1.08
1.06
1.04
1.02
1
0.98
0.96
0.94
0.92
0.9
-0.5
0
0.5
1
1.5
2


HW02, Problem 6 Spec2
Step response
10% rise time
90% rise time
Step Response Specs
Time, msec
1.5
1
0.5
0
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5

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