Exercise 2

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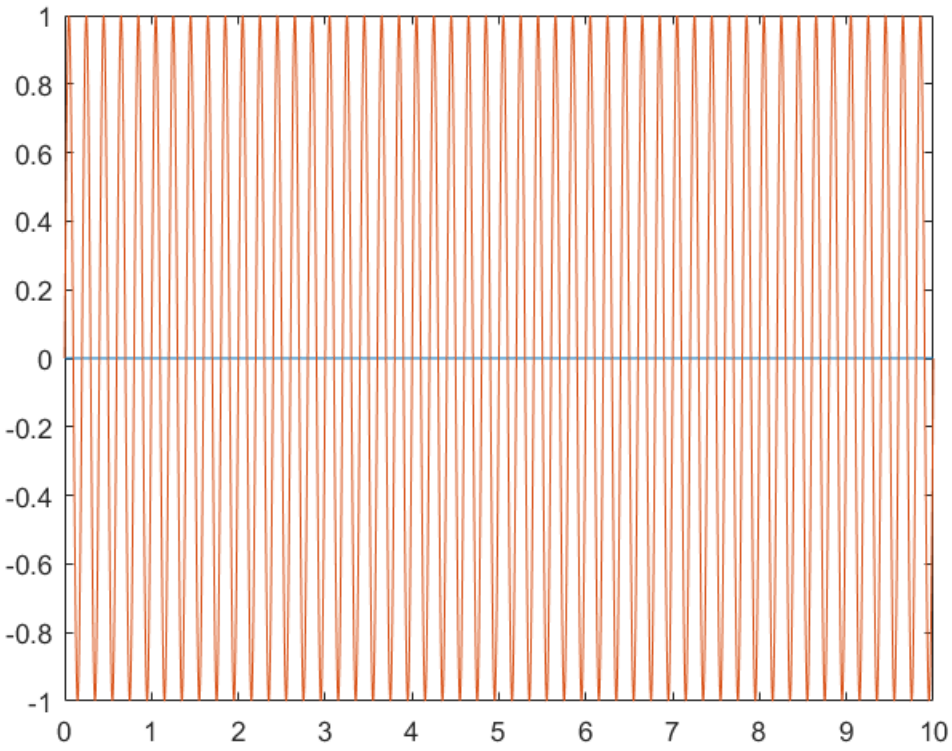
Exercise 2.1.1/2/3/4

- What is the maximal absolute difference between the sampled and continous signal (f=0.2)?
- What is the maximal absolute difference between the sampled and continous signal (f=1.0)?
- What is the maximal absolute difference between the sampled and continous signal (f=4.0)?
- What is the maximal absolute difference between the sampled and continous signal (f=4.5)?

```
for Freq = [0.2,1,4,5]
    Freq = Freq*2*pi;
    sim('Simulink/Exercise21');
plot(simout.time, simout.signals.values);
diff = simout.signals.values(:,1)-simout.signals.values(:,2);
Max = max(abs(diff));
peak = max(simout.signals.values(:,1));
bot = min(simout.signals.values(:,1));
amp = (abs(bot)+abs(peak))/2;
fprintf('Freq = %.2f\n',Freq/(2*pi))
fprintf('difference: %.3f, amplitude is: %.3f\n',Max, amp)
end
```

```
Freq = 0.20
difference: 0.123, amplitude is: 0.998
```

```
Freq = 1.00
difference: 0.578, amplitude is: 0.951
Freq = 4.00
difference: 1.885, amplitude is: 0.951
Freq = 5.00
difference: 1.000, amplitude is: 0.000
```

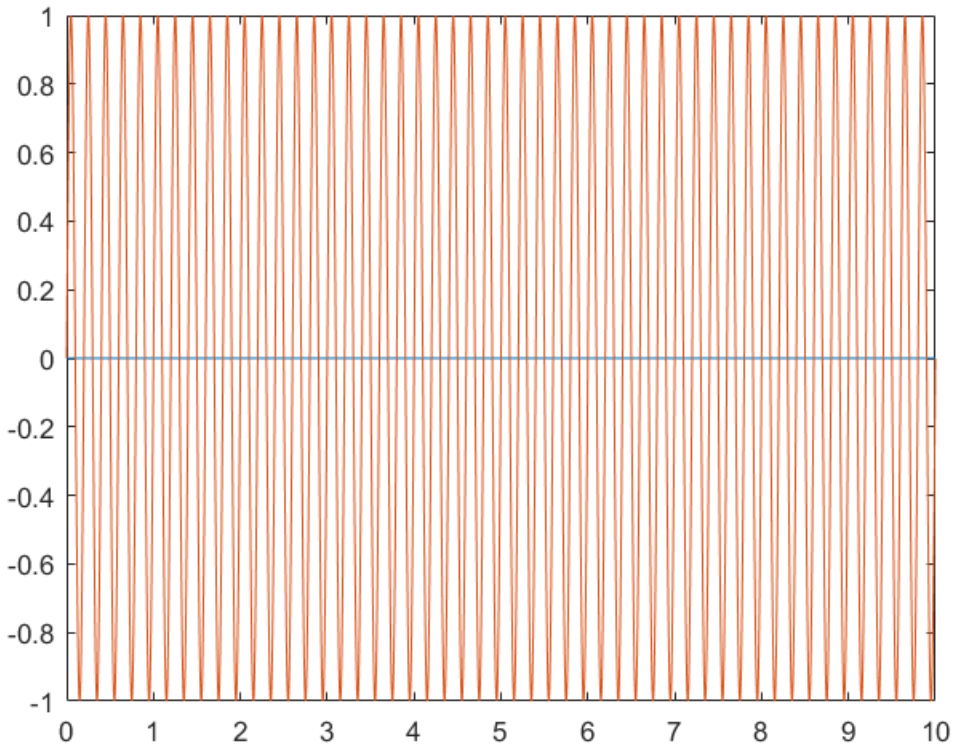


Exercise 2.1.5

- What is the amplitude of the sampled signal (f=5)?

```
Freq = 5*2*pi;
sim('Simulink/Exercise21');
plot(simout.time, simout.signals.values);
amp = max(simout.signals.values(:,1));
fprintf('At frequency = %.1f, amplitude is %.1f',Freq/(2*pi),amp);
```

```
At frequency = 5.0, amplitude is 0.0
```

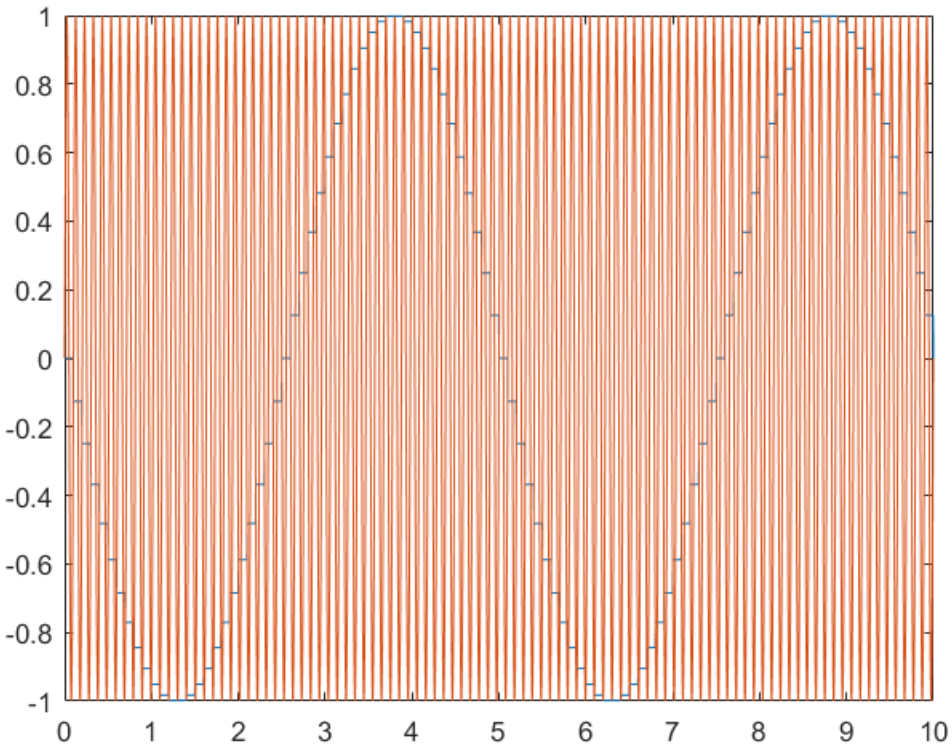


Exercise 2.1.6/7

- What is the frequency of the sampled signal (f=9)?
- What is the frequency of the sampled signal (f=9.8)?

```
Freq = 9*2*pi;
sim('Simulink/Exercise21');
plot(simout.time, simout.signals.values);
fprintf('At frequency = %.1f, seen as 1 Hz\',Freq/(2*pi));

Freq = 9.8*2*pi;
sim('Simulink/Exercise21');
plot(simout.time, simout.signals.values);
fprintf('At frequency = %.1f, seen as 1 Hz',Freq/(2*pi));
```

```
Warning: A lone trailing backslash, '\' , is not a
valid control character. See 'doc sprintf' for
control characters valid in the format string.
At frequency = 9.0, seen as 1 HzAt frequency = 9.8, seen as 1 Hz
```



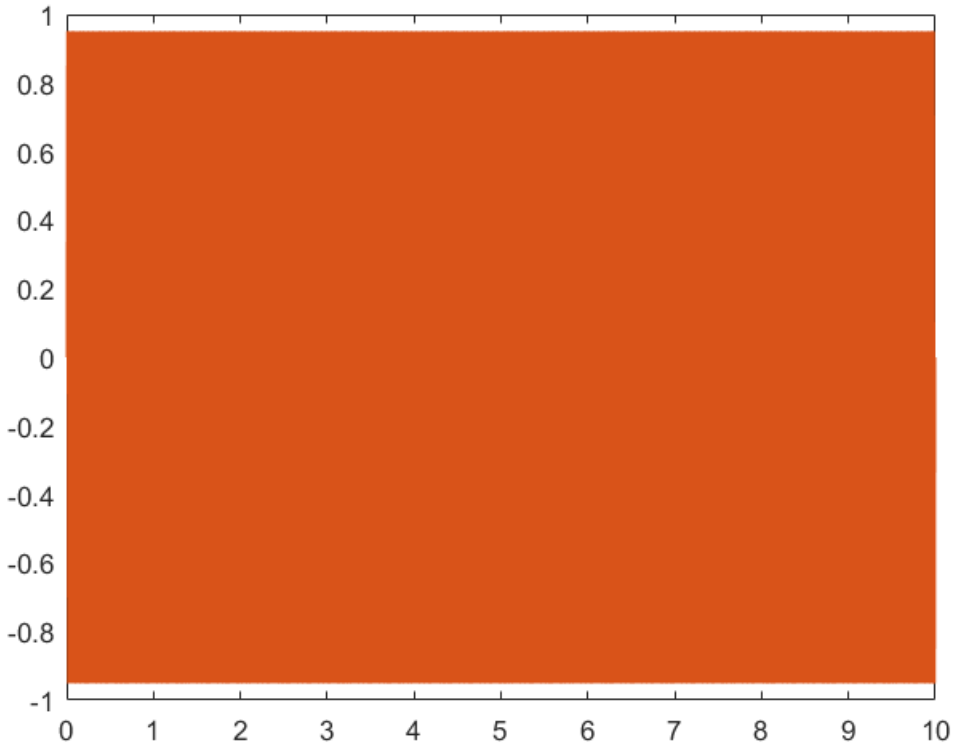
Exercise 2.1.8/9

- What is the amplitude of the sampled signal (f=10)?
- What is the amplitude of the sampled signal (f=50)?

```
Freq = 10*2*pi;
sim('Simulink/Exercise21');
plot(simout.time, simout.signals.values);
amp = max(simout.signals.values(:,1))
fprintf('At frequency = %.1f, amplitude is %.1f\n',Freq/(2*pi),amp);

Freq = 50*2*pi;
sim('Simulink/Exercise21');
plot(simout.time, simout.signals.values);
amp = max(simout.signals.values(:,1))
fprintf('At frequency = %.1f, amplitude is %.1f',Freq/(2*pi),amp);
```

```
amp =

   9.0174e-14

At frequency = 10.0, amplitude is 0.0

amp =
```

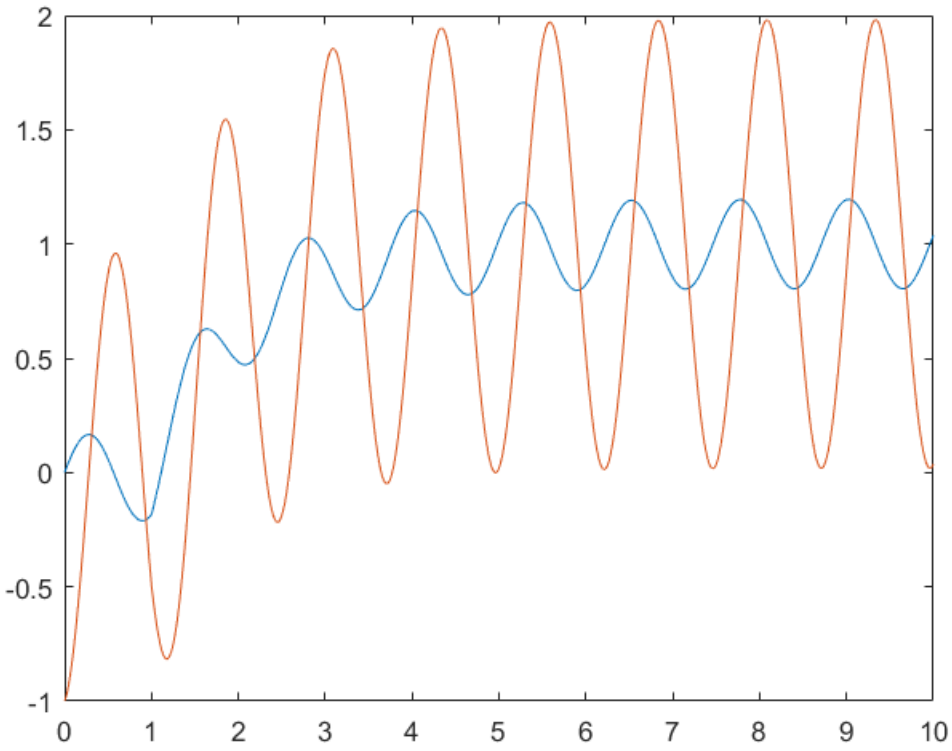
```
   5.6455e-13

At frequency = 50.0, amplitude is 0.0
```



Exercise 2.2.1

What is the peak to peak noise amplitude on the system output (f=0.8)?

```
k=1

Freq = 0.8*2*pi;
sim('Simulink/Exercise22');
plot(simout.time, simout.signals.values);
peak = max(simout.signals.values(2700:end,1));
bot = min(simout.signals.values(2700:end,1));
amp = peak-bot;
fprintf('The frequency is: %.3f',amp);


k =

     1

The frequency is: 0.397
```

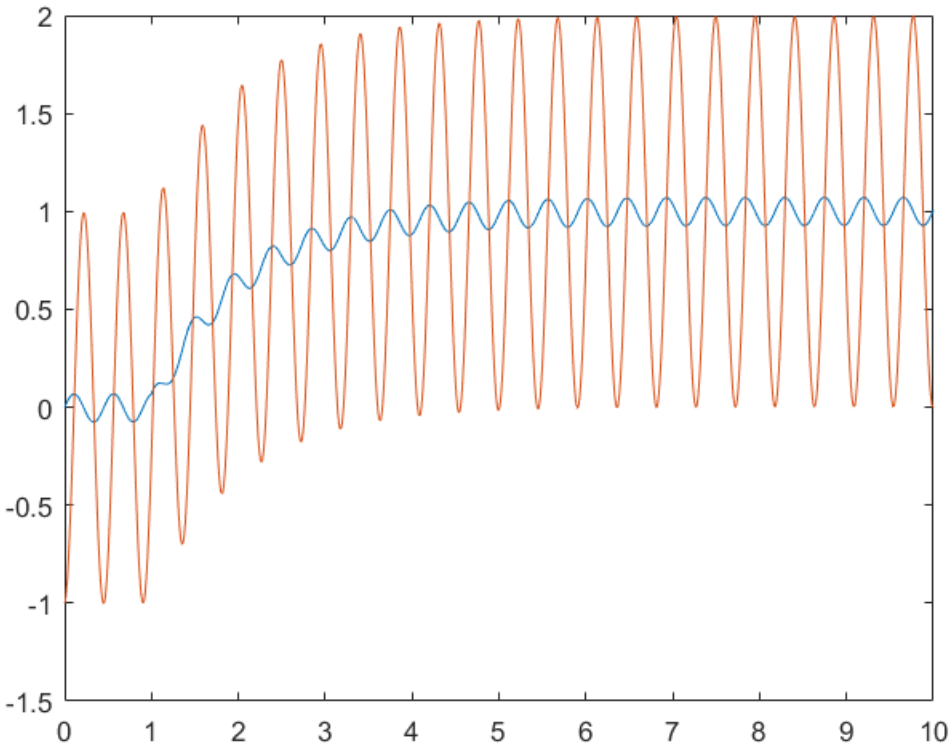


Exercise 2.2.2

What is the peak to peak noise amplitude on the system output (f=2.2)?

```
Freq = 2.2*2*pi;
sim('Simulink/Exercise22');
plot(simout.time, simout.signals.values);
peak = max(simout.signals.values(2700:end,1));
bot = min(simout.signals.values(2700:end,1));
amp = peak-bot;
fprintf('The frequency is: %.3f',amp);
```

```
The frequency is: 0.152
```

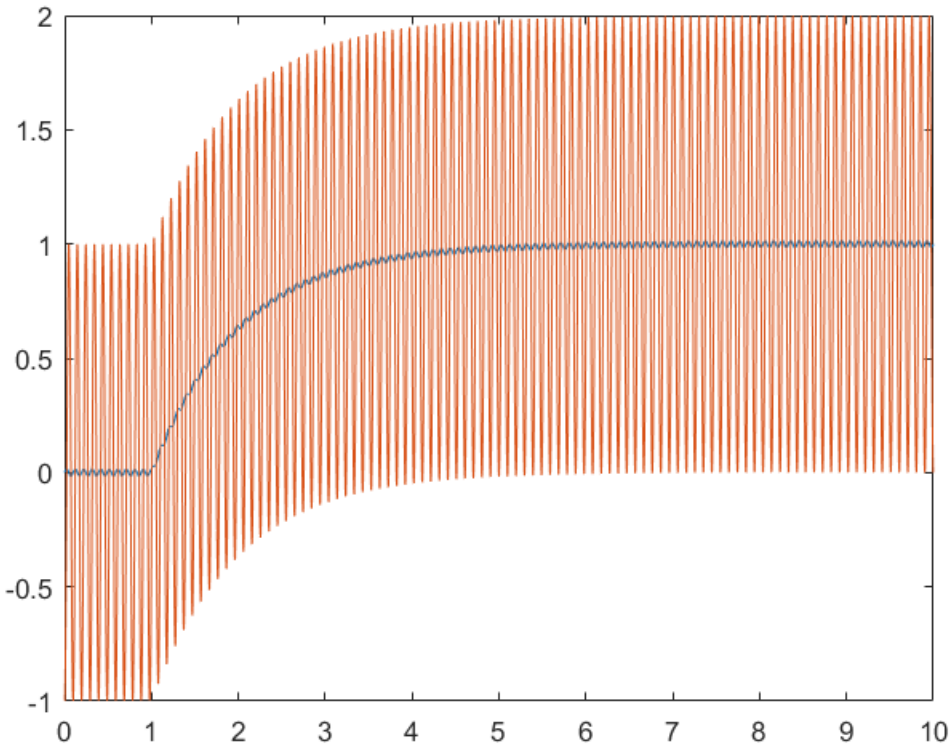


Exercise 2.2.3

What is the peak to peak noise amplitude on the system output (f=10.2)?

```
Freq = 10.2*2*pi;
sim('Simulink/Exercise22');
plot(simout.time, simout.signals.values);
peak = max(simout.signals.values(2700:end,1));
bot = min(simout.signals.values(2700:end,1));
amp = peak-bot;
fprintf('The frequency is: %.3f',amp);
```

```
The frequency is: 0.043
```



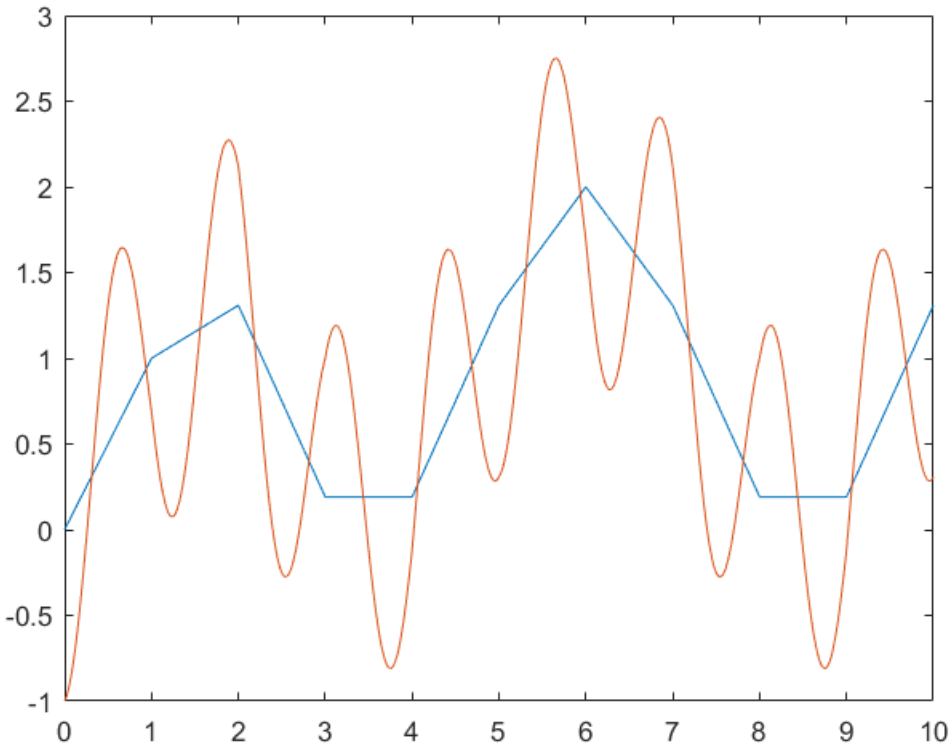
Exercise 2.3

Exercise 2.3.1

What is the peak to peak noise amplitude on the system output (f=0.8)

```
k=1
Freq = 0.8*2*pi;
sim('Simulink/Exercise23');
plot(simout.time, simout.signals.values);
peak = max(simout.signals.values(2700:end,1));
bot = min(simout.signals.values(2700:end,1));
amp = peak-bot;
fprintf('The frequency is: %.3f',amp);
```

```
k =

     1

The frequency is: 1.809
```

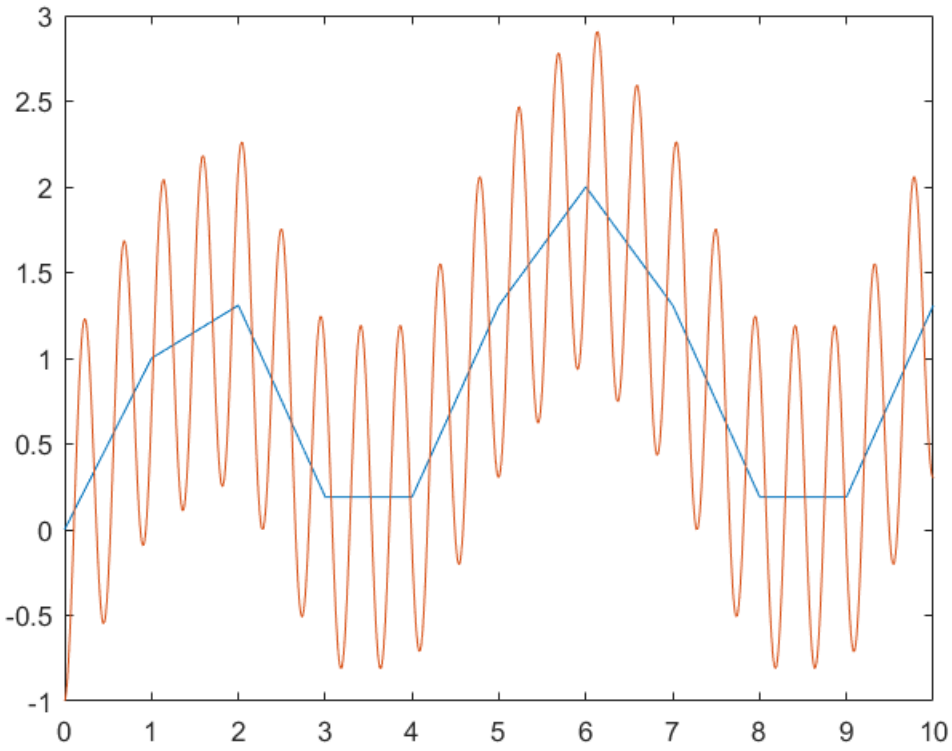


Exercise 2.3.2

What is the peak to peak noise amplitude on the system output (f=2.2)

```
Freq = 2.2*2*pi;
sim('Simulink/Exercise23');
plot(simout.time, simout.signals.values);
peak = max(simout.signals.values(2700:end,1));
bot = min(simout.signals.values(2700:end,1));
amp = peak-bot;
fprintf('The frequency is: %.3f',amp);
```

```
The frequency is: 1.809
```

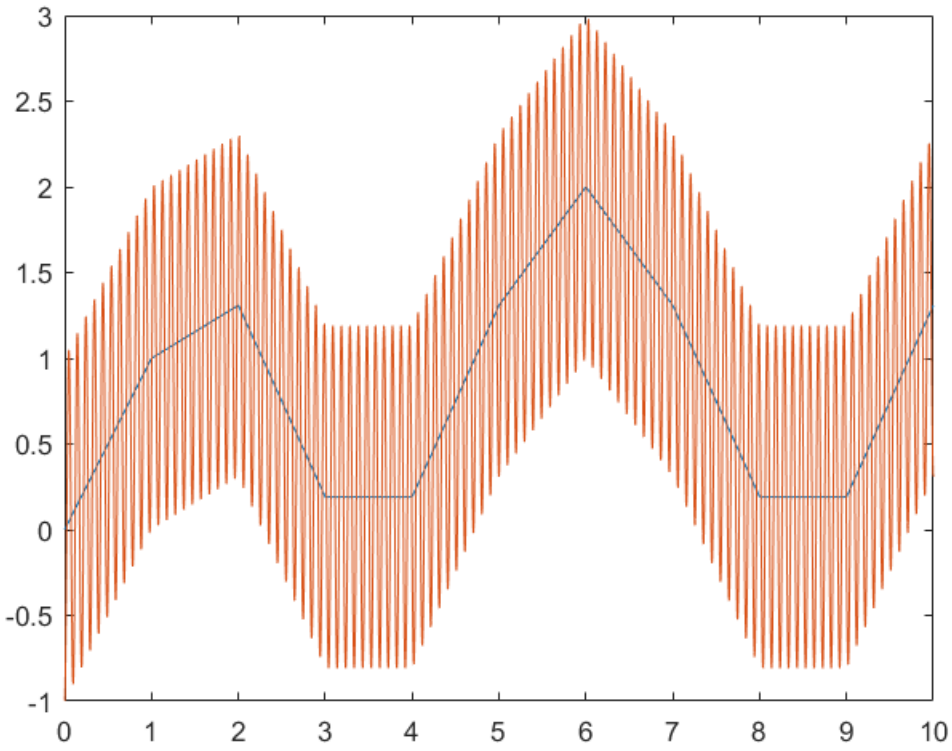


Exercise 2.3.3

What is the peak to peak noise amplitude on the system output (f=10.2)?

```
Freq = 10.2*2*pi;
sim('Simulink/Exercise23');
plot(simout.time, simout.signals.values);
peak = max(simout.signals.values(2700:end,1));
bot = min(simout.signals.values(2700:end,1));
amp = peak-bot;
fprintf('The frequency is: %.3f',amp);
```

```
The frequency is: 1.809
```

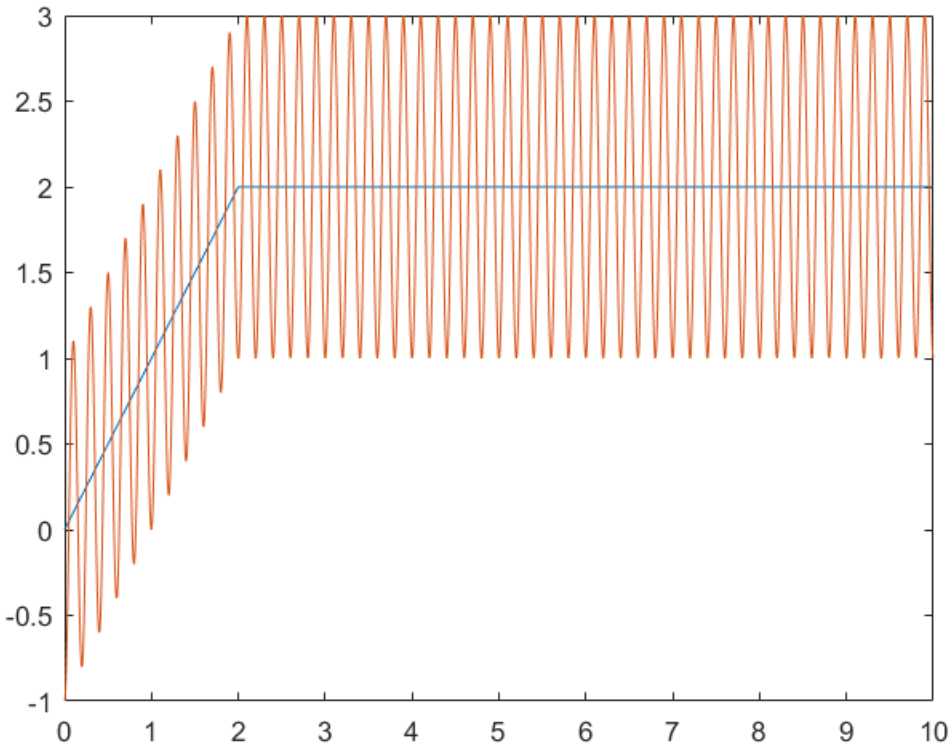


Exercise 2.3.4/5

- What is the maximum output error (f=5)?
- What is the frequency of the output error signal (f=5)?

```
Freq = 5*2*pi;
sim('Simulink/Exercise23');
plot(simout.time, simout.signals.values);
maxE = max(simout.signals.values(:,1)-1);
fprintf('The steadystate error is: %.3f\n',maxE);
fprintf('The frequency is 0, as there are no sinewave');
```

```
The steadystate error is: 1.000
The frequency is 0, as there are no sinewave
```



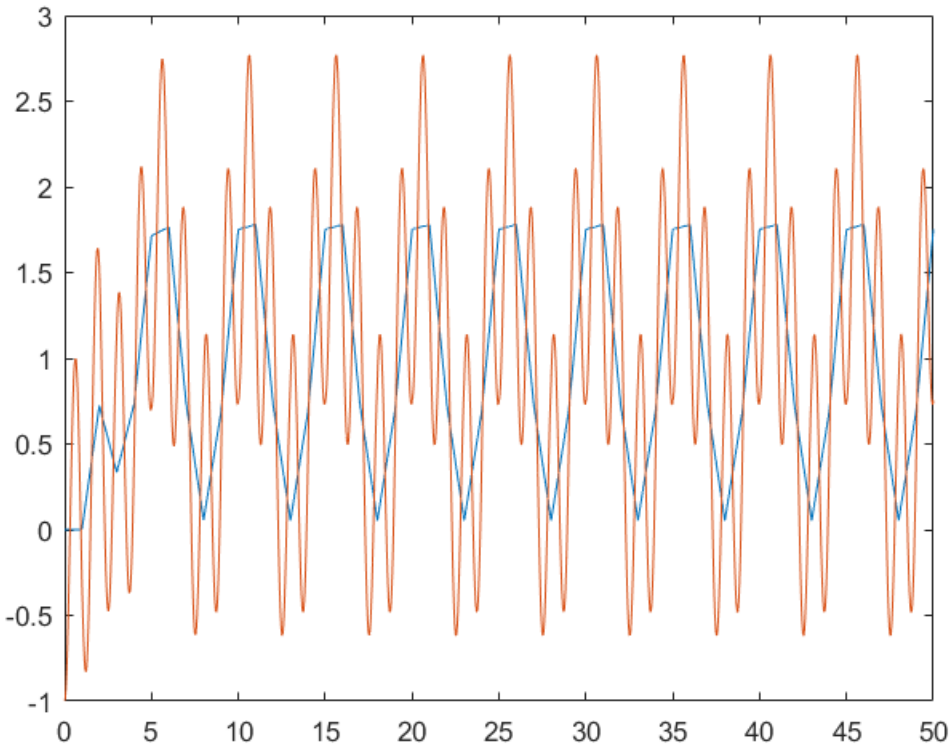
Exercise 2.4

Exercise 2.4.1

What is the peak to peak noise amplitude on the system output (f=0.8)?

```
Tau = 0.159;

Freq = 0.8*2*pi;
sim('Simulink/Exercise24');
plot(simout.time, simout.signals.values);
peak = max(simout.signals.values(2700:end,1));
bot = min(simout.signals.values(2700:end,1));
amp = peak-bot;
fprintf('The frequency is: %.3f',amp);
```

```
The frequency is: 1.727
```

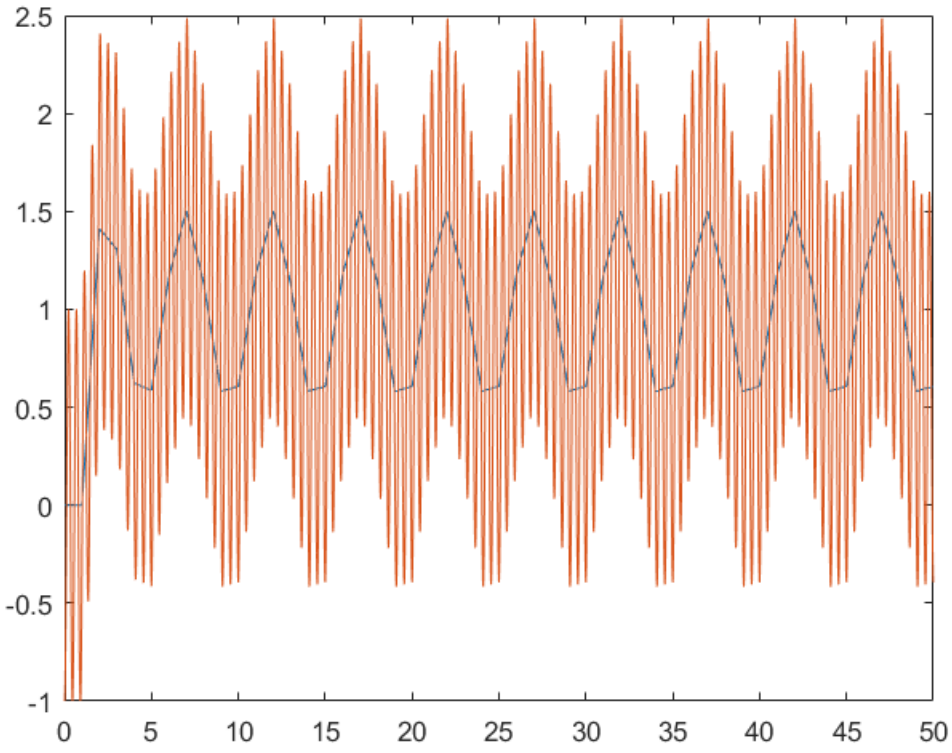


Exercise 2.4.2

What is the peak to peak noise amplitude on the system output (f=2.2)?

```
Freq = 2.2*2*pi;
sim('Simulink/Exercise24');
plot(simout.time, simout.signals.values);
peak = max(simout.signals.values(2700:end,1));
bot = min(simout.signals.values(2700:end,1));
amp = peak-bot;
fprintf('The frequency is: %.3f',amp);
```

```
The frequency is: 0.922
```

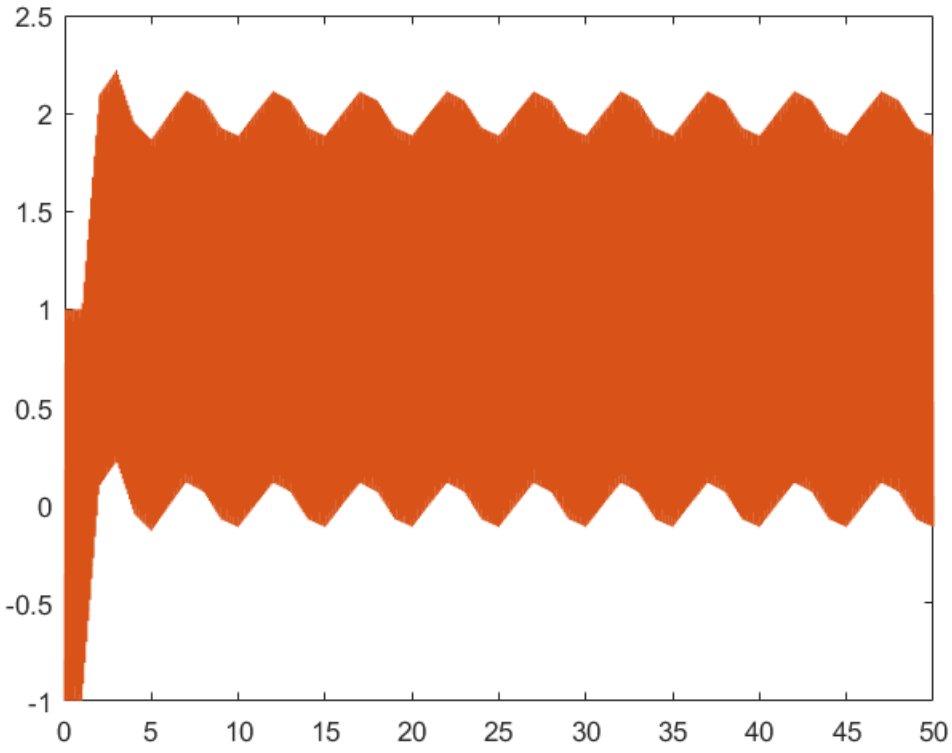


Exercise 2.4.3

What is the peak to peak noise amplitude on the system output (f=10.2)?

```
Freq = 10.2*2*pi;
sim('Simulink/Exercise24');
plot(simout.time, simout.signals.values);
peak = max(simout.signals.values(2700:end,1));
bot = min(simout.signals.values(2700:end,1));
amp = peak-bot;
fprintf('The frequency is: %.3f',amp);
```

```
The frequency is: 0.227
```

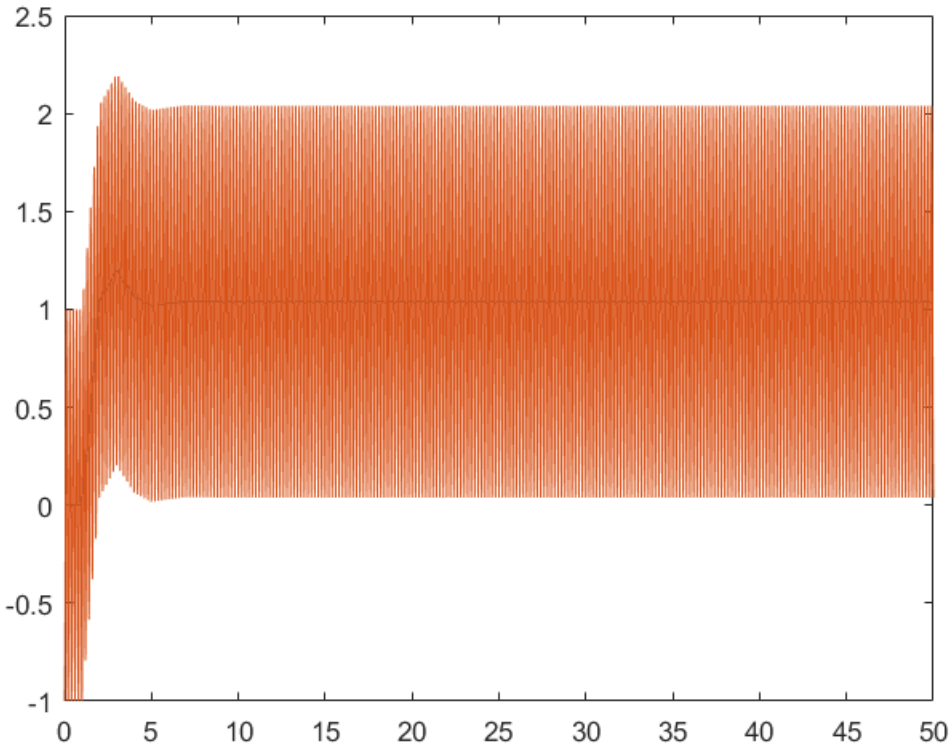


Exercice 2.4.4/5

- What is the maximum output error (f=5)?
- What is the frequency of the output error signal (f=5)?

```
Freq = 5*2*pi;
sim('Simulink/Exercise24');
plot(simout.time, simout.signals.values);
maxE = max(simout.signals.values(5005,1))-1;
fprintf('The steadystate error is: %.3f\n',maxE);
fprintf('The frequency is 0, as there are no sinewave');
```

```
The steadystate error is: 0.038
The frequency is 0, as there are no sinewave
```



Exercise 2.5

- What is the value of tau? (calculate)
- What is the value of k? (simulate step respose without noise)

```
Tau = 1/(2*pi*0.22);
k=0.6;
Freq = 2.2*2*pi;
set_param('Exercise24','StopTime','50');
sim('Simulink/Exercise24');
plot(simout.time, simout.signals.values);
dampening = (max(simout.signals.values(2700:end,2))-1)/
(max(simout.signals.values(2700:end,1))-1);
overshoot = (max(simout.signals.values(:,1))-1)*100;
fprintf('Tau is: %.3f, Dampening: %.1f\n',Tau,dampening);
fprintf('k is: %.3f, overshoot: %.2f%%\n' ,k, overshoot);
set_param('Simulink/Exercise24','StopTime','10');
```

```
Tau is: 0.723, Dampening: 13.0
k is: 0.600, overshoot: 20.22%

Error using Exercise2 (line 192)
Invalid Simulink object name: Simulink/Exercise24

Caused by:
```

```
Error using Exercise2 (line 192)
No block diagram 'Simulink' is loaded
```

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