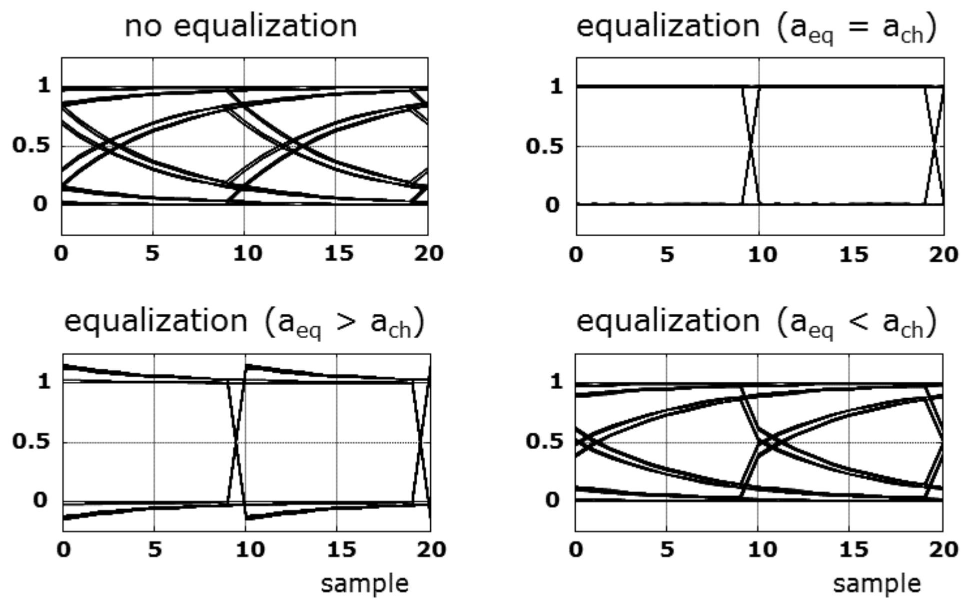
LAB 3 - TASK 3 (1 point possible)

In Part I of this course, we introduced the concept of an equalizer to compensate for the effects of the channel. Because the channel was bandlimited, it introduced intersymbol interference. This caused the eye diagram to close. The equalizer "undid" the effect of the channel, and resulted in a more open eye. Recall that the equalizer depended upon an estimate of the exponential parameter a of the channel. If the estimate is correct, the effects of the channel can be cancelled exactly, resulting in an open and square eye. However, if the estimate is incorrect (too high or too low), then the eye is not exactly square, as shown in the figure below. We implemented the equalizer in Lab 6 of Part I.



While in the previous part of this course we studied the channel and the equalizer in the time domain, here we study them in the frequency domain. In this lab, we will re-examine the operation of the equalizer. Be reminded that we had to characterize the relationship between the channel input and output and then we designed the equalizer. As a result, we reduced the intersymbol interterfence and showed the results using the eye diagram. In this task, we will study the effect of equalization on the channel using the frequency response. We will compare the amplitudes of the frequency responses of the channel with and without equalization. We will also measure the amplitude of the frequency response of the equalizer itself.

5.5 Lab 3 - Frequency Response
Lab due Nov 16, 2015 at 15:30 UTC

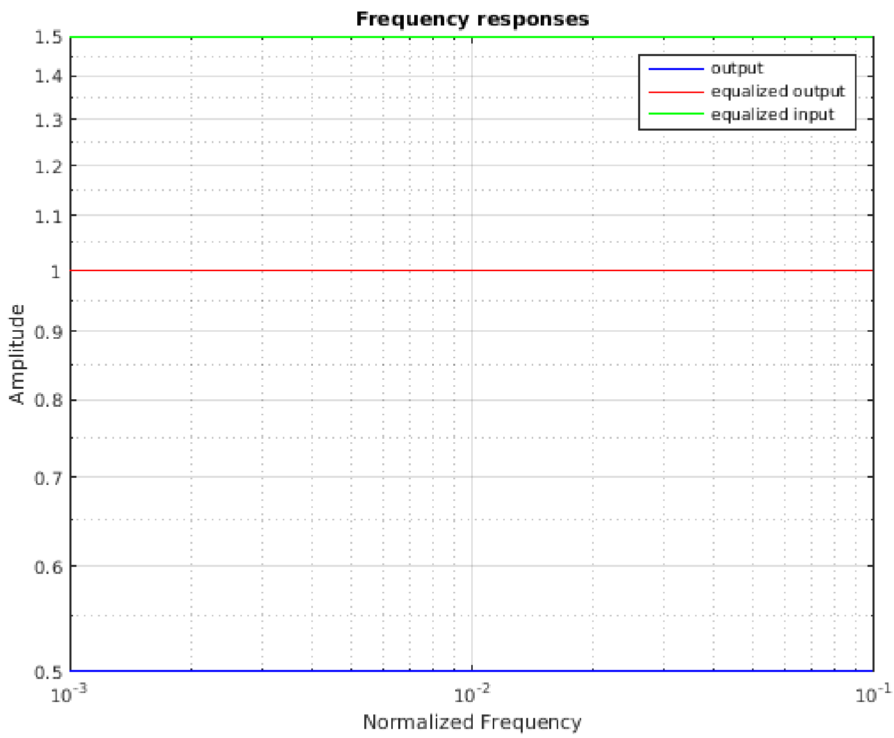
- Topic 6: The Discrete Fourier Transform
- MATLAB download and tutorials
- MATLAB Sandbox

```
% % % % Do not change the code below % % % %

end
figure(1);
% Divide the peak to peak amplitude of the output by
% the peak to peak amplitude of the input (2)
loglog(flist,h_rx/2,'b');
hold on;
loglog(flist,h_eq_rx/2,'r');
loglog(flist,h_eq_tx/2,'g'); hold off;
grid
legend('output','equalized output','equalized input');
xlabel('Normalized Frequency');
ylabel('Amplitude');
```

Unanswered

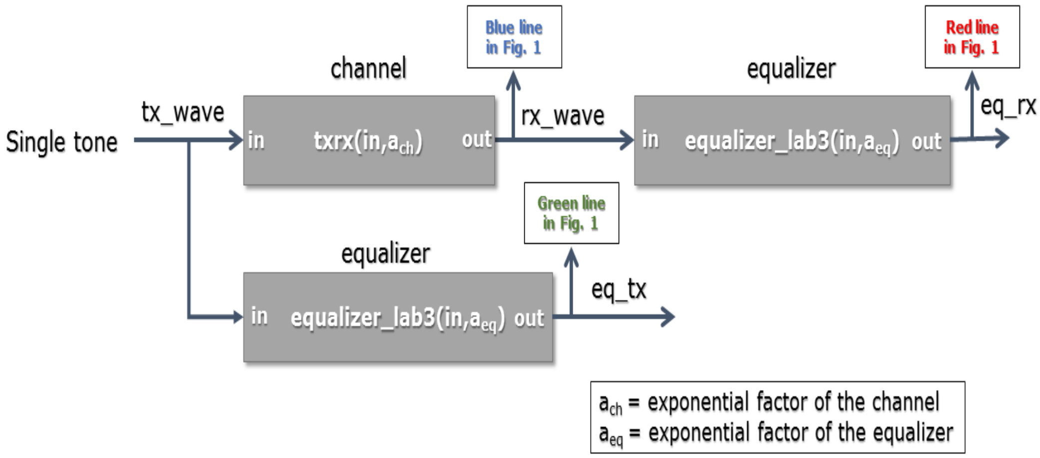
Figure 1



Run Code

INSTRUCTIONS

The MATLAB code above should transmit cosine waves of different frequencies (**tx_wave**) through the channel and record the output both with (**eq_rx**) and without equalization (**rx_wave**). It should also send the input signal **tx_wave** directly through the equalizer so that we can measure its frequency response (**eq_tx**). The connections among these signals are shown in the figure below.



Finally, the code should plot the frequency responses of the channel, the equalized channel and the equalizer on a single graph.

Your first task in this lab is to revise the code in order to obtain the peak to peak response of the above mentioned signals, and store them inside the variables, **h_tx**, **h_rx**, **h_eq_rx**, **h_eq_tx**, respectively. The basic structure of this code is very similar to that you have seen in Task 2. You should make similar modifications, as well as make sure that the signals **eq_rx** and **eq_tx** are computed correctly. The equalizer is implemented using the MATLAB function **out = equalizer_lab3(in,aeq)** where **in** is the input waveform (either the input or output of the channel), **aeq** is the equalizer's estimate of the exponential parameter of the channel (**ach**), and **out** stores the output waveform from the equalizer. The values of **ach** and **aeq** should be the same, but in many practical situations they are different, because the equalizer does not have a perfect model of the channel.

When modifying the code, do not modify the variables **ach**, **aeq**, **nsamp** and **flist**. Remember that when you study the peak to peak response you need to remove the transient response of the signal. For this lab, you can safely assume that the transient response ends before the first 200 samples.

Once you have successfully checked your work, experiment with the code by modifying the parameter **aeq** of the equalizer and use the insight gained to answer the questions below. You have an unlimited number of submissions on this task.

LAB 3 - TASK 3 QUESTION 1 (1 point possible)

Suppose that the aeq < ach. Which of the following is/are true?

- [ ] The equalizer thinks the step response of the channel rises more slowly than it actually does.
- [ ] The equalizer thinks the step response of the channel rises faster than it actually does.
- [ ] High frequencies are amplified by too little after equalization.
- [ ] The equalizer perfectly cancels the effect of the channel.

?

You have used 0 of 3 submissions

LAB 3 - TASK 3 QUESTION 2 (1 point possible)

Suppose that the aeq = ach. Which of the following is/are true?

- [ ] The equalizer thinks the step response of the channel rises more slowly than it actually does.
- [ ] The frequency response of the channel after equalization is flat (constant).
- [ ] High frequencies are not amplified enough after equalization.
- [ ] The equalizer perfectly cancels the effect of the channel.

?

You have used 0 of 3 submissions

LAB 3 - TASK 3 QUESTION 3 (1 point possible)

What type of filter is the equalizer?

- Low Pass
- Band Pass
- High Pass

?

You have used 0 of 1 submissions