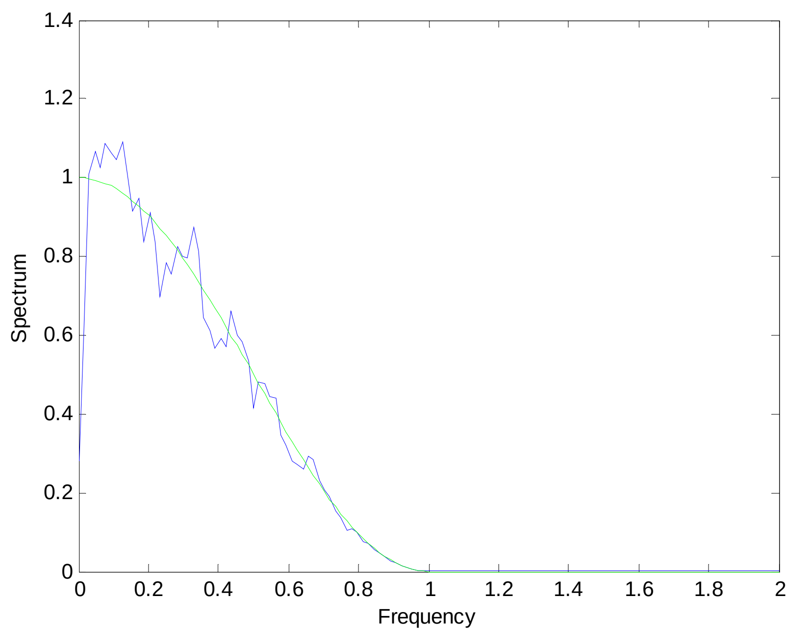
Problem 10.31 In this experiment, we simulate the performance of bipolar signalling in additive white Gaussian noise but with root-raised-cosine pulse shaping. A Matlab script is included in Appendix 7 for doing this. With this simulation:
(a) Compute the spectrum of the transmitted signal and compare to the theoretical. Also compare to the transmit spectrum with rectangular pulse shaping
(b) Plot the eye diagram of the received signal under no noise conditions. Explain the relationship of the eye opening to bit error rate performance.
(c) Confirm the theoretically predicted bit error rate for E_b/N_0 from 0 to 10 dB.

Solution

(a) We compare the spectra by inserting the following statements prior to noise being added to the signal

```
[P,F] = spectrum(S,256,0,Hanning(256),Fs);
plot(F,P(:,1));
midpt = floor(length(F)/2);
hold on, plot(F, abs([(1+cos(pi*F(1:midpt)))/2; 0*F(midpt+1:end)]),'g'), hold off
xlabel('Frequency'), ylabel('Spectrum')
```

The comparison plot is shown below.



(b) To plot the eye diagram we eliminate the noise by setting E_b/N_0 to a high value

Eb_N0 = 2000;

Then running the Matlab script produces the following eye diagram.

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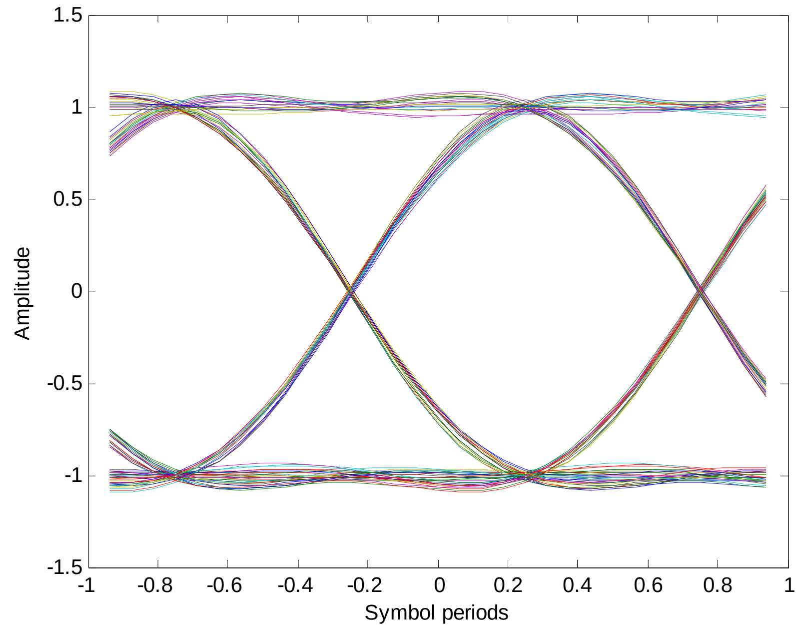
Problem 10.31 continued



(c) We simulate the bit error rate by commenting out the plotting statements and adding a set of statements similar to those used in Problem 10.30.