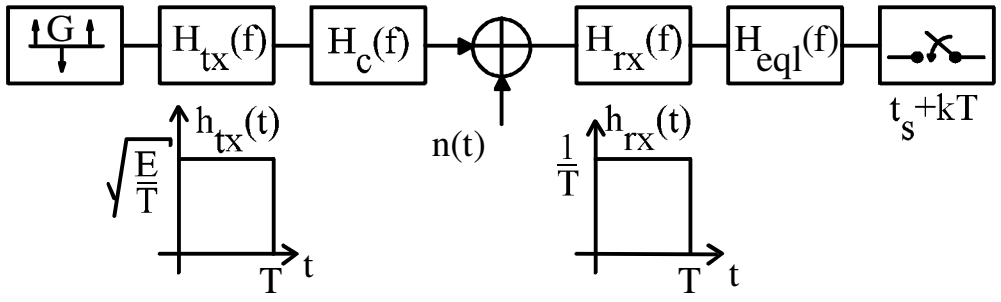
S-72.232 RADIO COMMUNICATION SYSTEMS
EXERCISE 4/2005
4.3.2005

15.



$$h_c(t) = 0.5\delta(t) + \delta(t - 0.5T) + 0.9\delta(t - 2T)$$

The figure shows the system in Problem 11 with the Viterbi-equalizer replaced by a linear channel equalizer with the transfer function being the inverse of the channel transfer function. Symbol timing recovery works as in Problem 11.

a) Calculate the samples of the equalized pulse waveform and the equalizer output noise power.
b) Determine the upper bound error probability expression based on worst case ISI and estimate the degradation caused by multipath propagation to this receiver and how many dB this receiver performance is worse than the single symbol receiver matched to the multipath channel output pulse waveform at the BER-level 10^{-6}.

16. The equalizer in the previous problem is replace with a transversal equalizer containing i) 2 taps, ii) 3 taps, or iii) 4 taps. The detector perfoms symbol by symbol ML-decisions based on the equalized signal samples. This synchronous equalizer uses the ZF-principle.
a) Determine the tap coefficients of the fully adapted equalizer.
b) Determine the samples of the equalized pulse waveform and the the equalizer output noise power.
c) Determine the upper bound error probability expression based on worst case ISI and estimate the degradation caused by multipath propagation to this receiver and how many dB this receiver performance is worse than the single symbol receiver matched to the multipath channel output pulse waveform at the BER-level 10^{-6}.

17. The equalizer in the previous problem is replace with a transversal equalizer containing i) 2 taps, ii) 3 taps, or iii) 4 taps. The detector perfoms symbol by symbol ML-decisions based on the equalized signal samples. This synchronous equalizer uses the MMSE-principle.

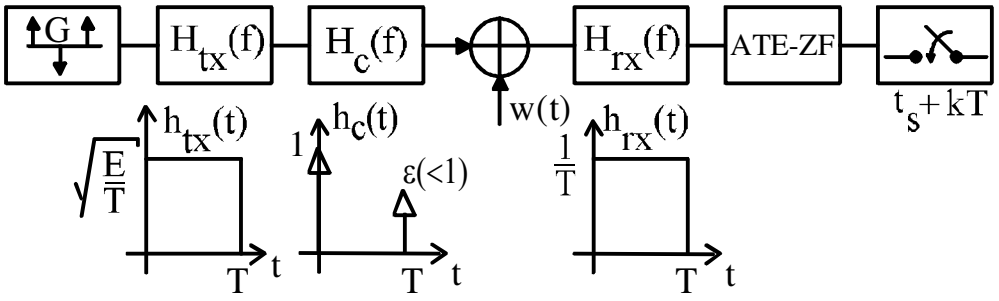
a) Determine the tap coefficients of the fully adapted equalizer assuming a high signal to noise ratio.

b) Determine the samples of the equalized pulse waveform and the the equalizer output noise power.

c) Determine the upper bound error probability expression based on worst case ISI and estimate the degradation caused by multipath propagation to this receiver and how many dB this receiver performance is worse than the single symbol receiver matched to the multipath channel output pulse waveform at the BER-level 10^{-6}.

18. Repeat Problem 16 when the synchronous equalizer is replaced with a fractional transversal equalizer with the delay element 0.75T, where T is the symbol duration.

HOMEWORK 4. Return time 1 month, at latest before the May 2005 exam



The figure shows a bipolar binary system using i) a 2-tap or ii) 3-tap transversal ZF-equalizer.

a) Determine the tap coefficients using the first tap as the reference tap.

b) Determine the equalizer output pulse waveform samples at the time instants kT and the output noise power.

c) Determine the error probability expression and estimate how many dB worse the performance of this receiver is at the error probability level 10^{-6} compared to the single symbol ML-receiver matched to the received pulse waveform.