Course of Optical Communications – Telecommunication Engineering

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Practice Work n°6 – 31/05/2006

Last Name: _____ **First Name:** _____

PROBLEMS

6.1 In the intensity modulation (IM) the most practical down-conversion technique is direct detection (DD). In this framework, we can adopt both carrierless and carrier-based schemes. Could you tell what of the next modulations correspond to carrierless schemes and carrier-based schemes?

OOK

BPSK

PPM

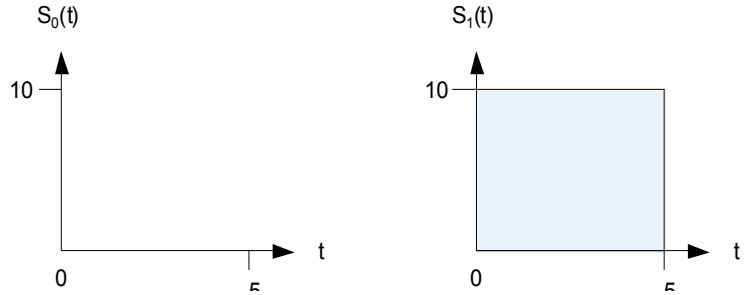
DSSS

OFDM

QPSK

FHSS

6.2 In a ON-OFF (NZR) keying modulation, we have the following symbol signals:



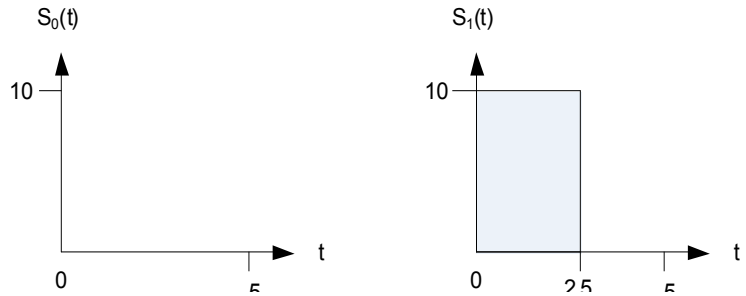
ON-OFF (NZR) KEYING MODULATION

a) What is the average bit power P_t if the both bits '0' and '1' are equiprobable?

b) What is the period T?

c) What would it be the average bit power P_t if we had a '0' bit probability P_0=1/3 and a '1' bit probability P_1=2/3?

6.3 Let us consider an OOK modulation using RZ pulses with a duty cycle γ=0.5, with symbols shown below.

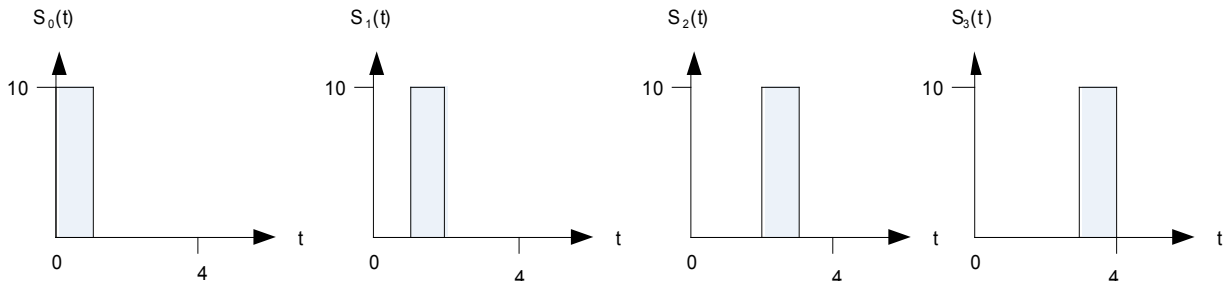


OOK MODULATION USING RZ PULSES (γ=0.5)

a) What is the average bit power P_t if the both bits '0' and '1' are equiprobable?

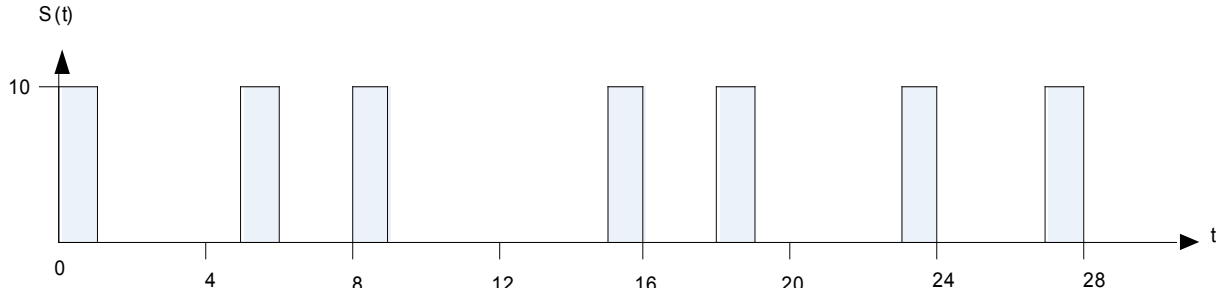
b) What is the period T?

6.4 Let us assume we have a 4-Pulse-Position Modulation (4-PPM). The signals $S_x(t)$ are shown in the following figure, where each symbol correspond to a sequence of bits as follows: $S_0(t)$='00', $S_1(t)$='01', $S_2(t)$='10', $S_3(t)$='11'.



a) What signals should we emit if we want to transmit the sequence "00101100101001"?

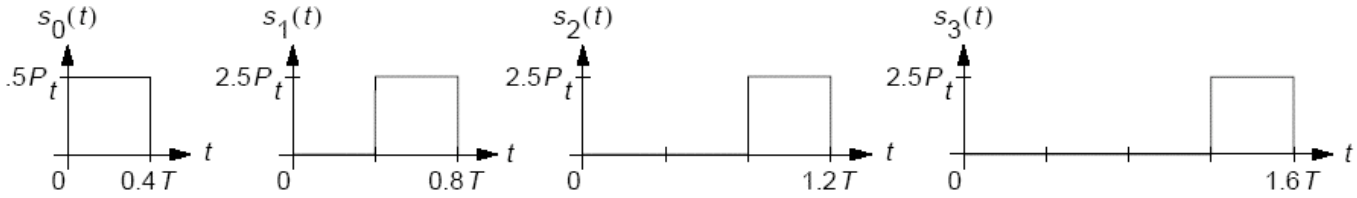
b) What would it be the sequence of bits that we have received if at the receiver we get the following signal?



6.5 How many bits are encoded in a symbol if we use a 16-PPM modulation? And how many if we use a 32-PPM modulation?

6.6 For a given bit rate, L-PPM requires more bandwidth than OOK. In absence of multipath distorsion, how much more bandwidth than OOK will we need if we use a 32-PPM?

6.7 Let us consider a system using a 4-DPPM scheme. The signals $S_x(t)$ are shown in the following figure, where each symbol correspond to a sequence of bits as follows: $S_0(t)$='00', $S_1(t)$='01', $S_2(t)$='10', $S_3(t)$='11'.



(b) 4-DPPM

What signals should we emit if we want to transmit the sequence "001011001001"?

6.8 Which of the following modulation schemes requires more bandwidth: OOK, BPSK or QPSK?