ONS Problem Set 2

Wednesday, November 9, 2016

Problem "0": Transmitter & Receiver Filters, Matched Filter (from last tutorial)

a) Describe a transmission system mathematically using a transmitter filter $p(t)$ and receiver filter $q(t)$.
b) From the equation derived in part a), calculate the signal-to-noise ratio (SNR) and show that a matched filter maximizes the SNR.
c) Give the units of the time signals and the filter impulse responses.

Problem 1: Chromatic Dispersion

Chromatic dispersion leads to a pulse broadening of the optical time-domain signal and hence to inter-symbol interference (ISI). Calculate the maximum reach of an on-off-keying (OOK) data signal transmitted through an optical fiber. The optical carrier wavelength shall be 1550 nm and the data rates are $R_1 = 10$ Gbit/s and $R_2 = 20$ Gbit/s. Assume a hypothetical noise-free transmission system with a Gaussian Tx filter. Assume furthermore that the pulse broadening in the optical fiber due to chromatic dispersion can be approximated by a Gaussian impulse response.

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