

**In the Name of God**

**Communication Systems**

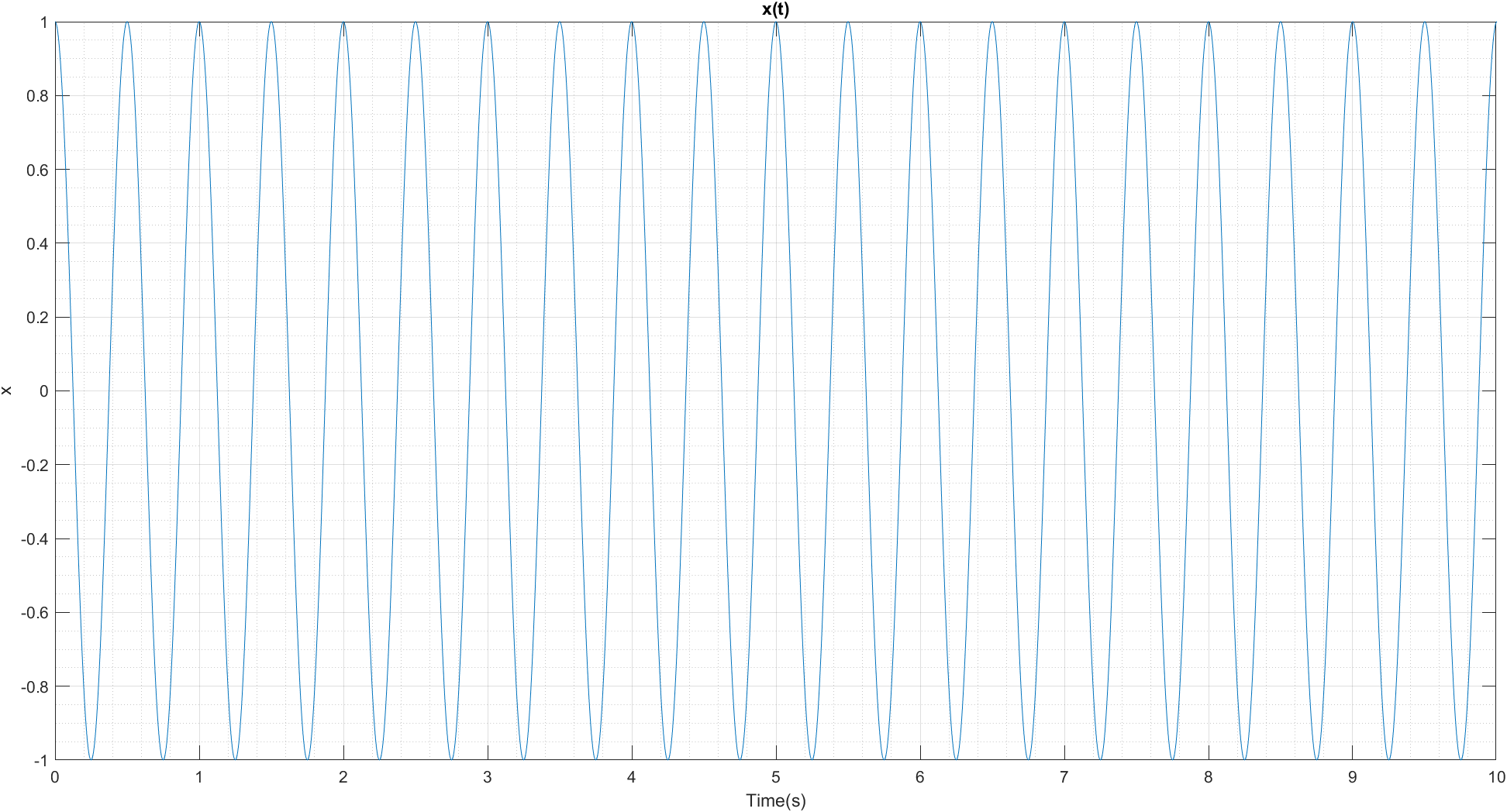
Computer Homework\_1 Report

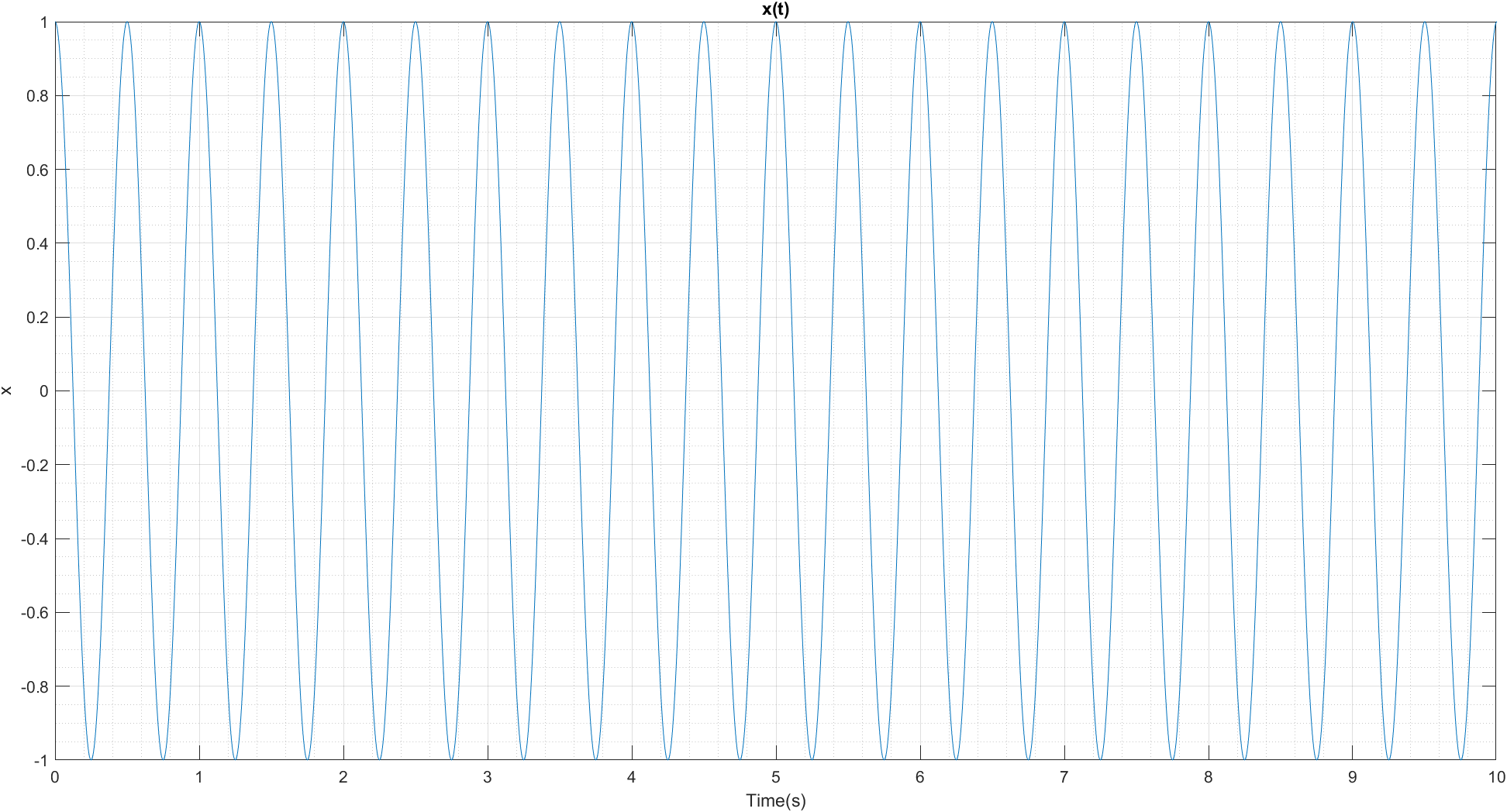
Multi-Path Channels &

Signal Reconstruction

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1. Multi-Path Channels:

1.1 -

1.2 –

paramters:

mu = 0;

sigma = 0.5;

Tm = 0.01;

n = [1 10]; % length of a

a = normrnd(mu,sigma,n); % coeffiecients of impulses

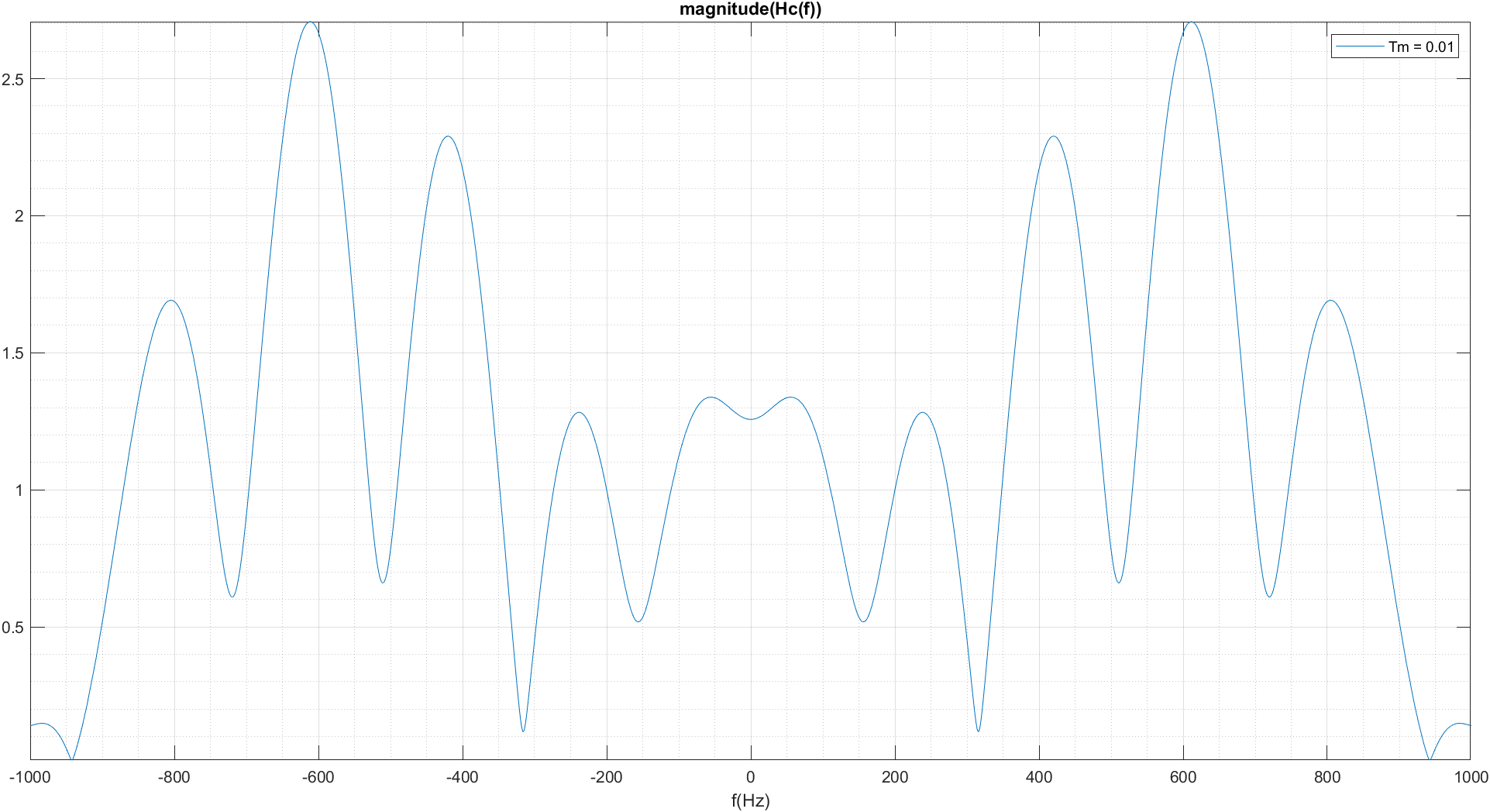
tau = unifrnd(0,Tm,n); % shiftings of impulses

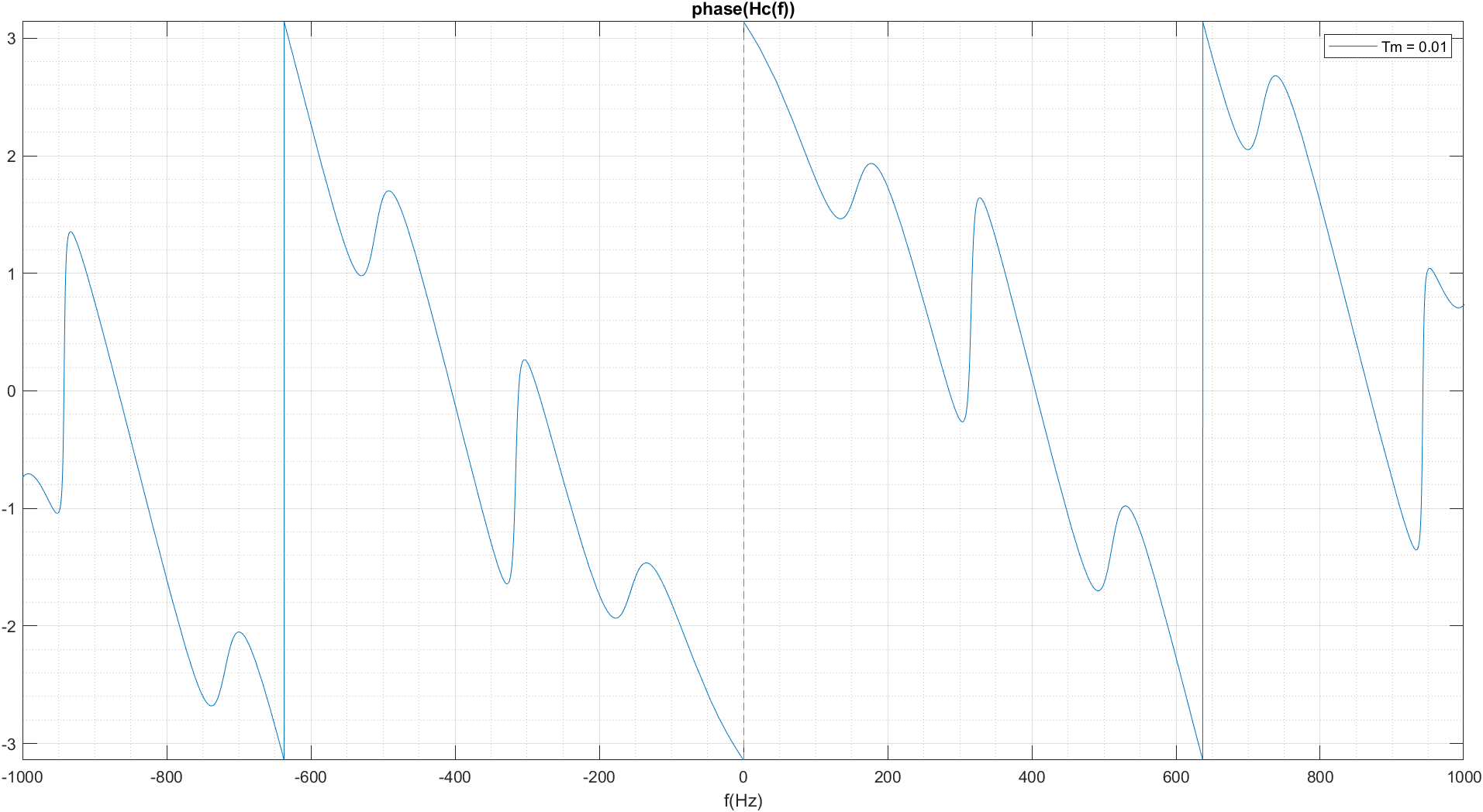
Hc is defined using a syms function and then using abs and angle, the magnitude and phase of the channel is drawn:

syms f;

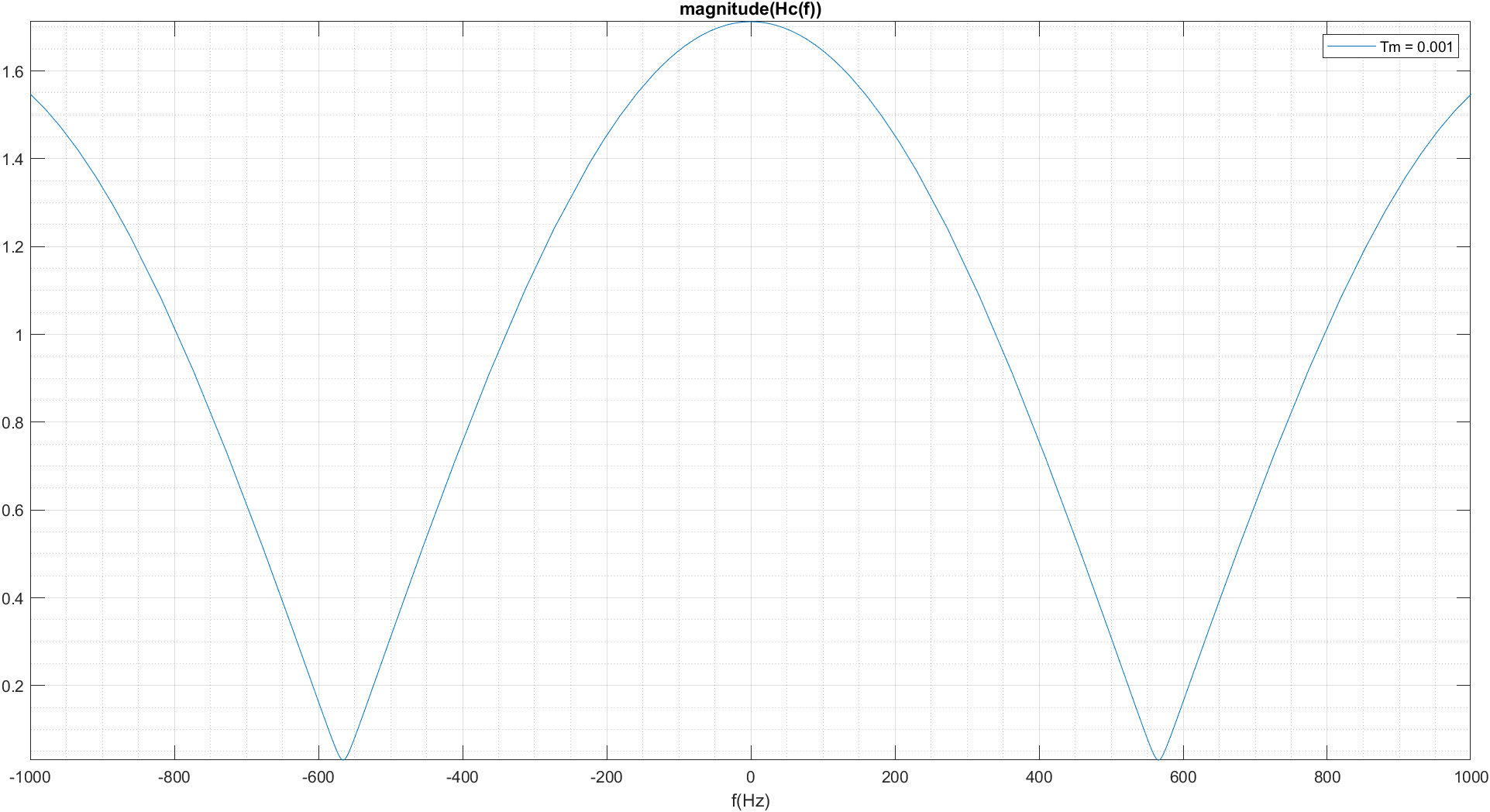
syms HcF(f);

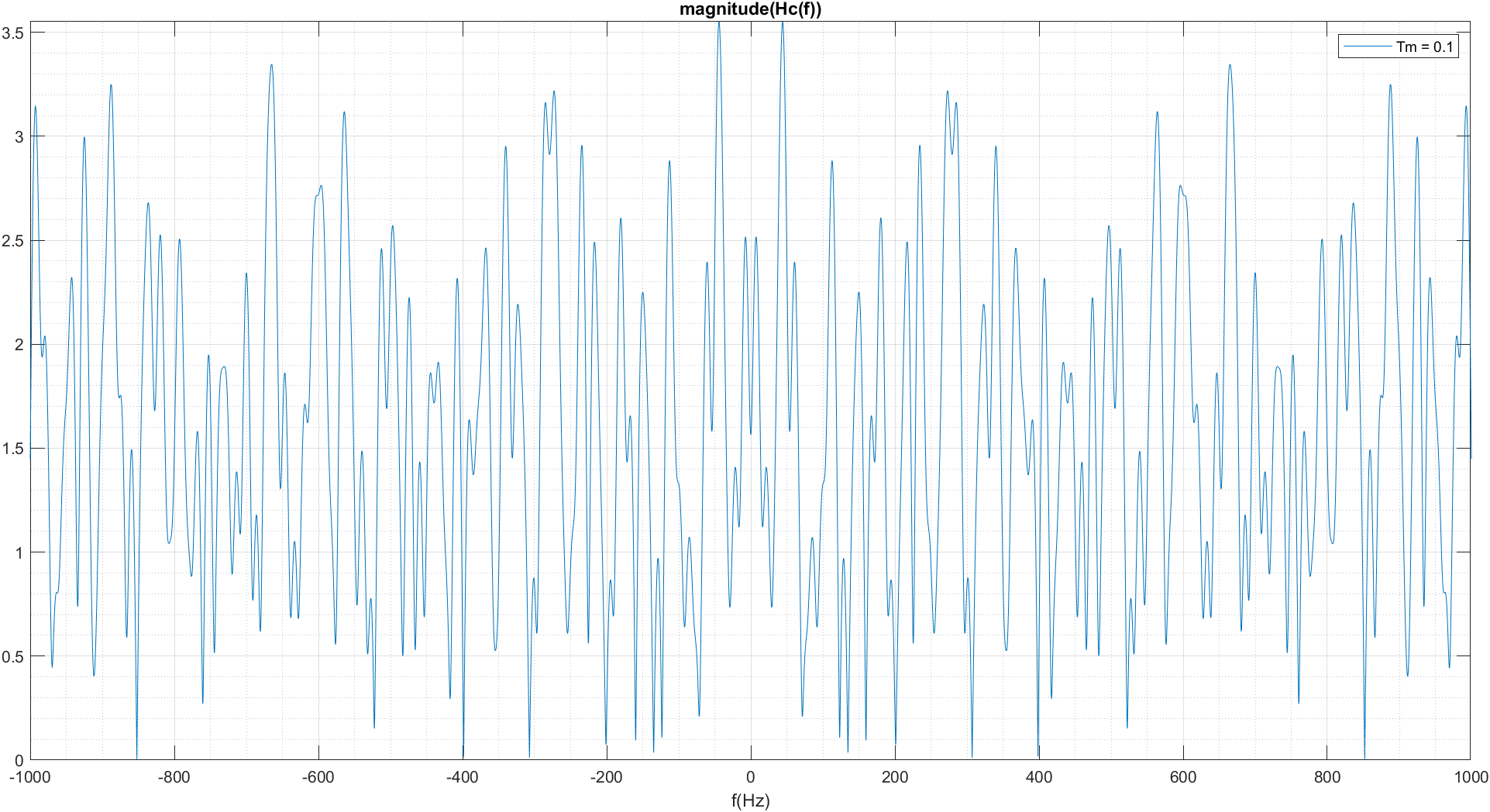
HcF(f) = sum(a.\*exp(-1i\*2\*pi\*f.\*tau));





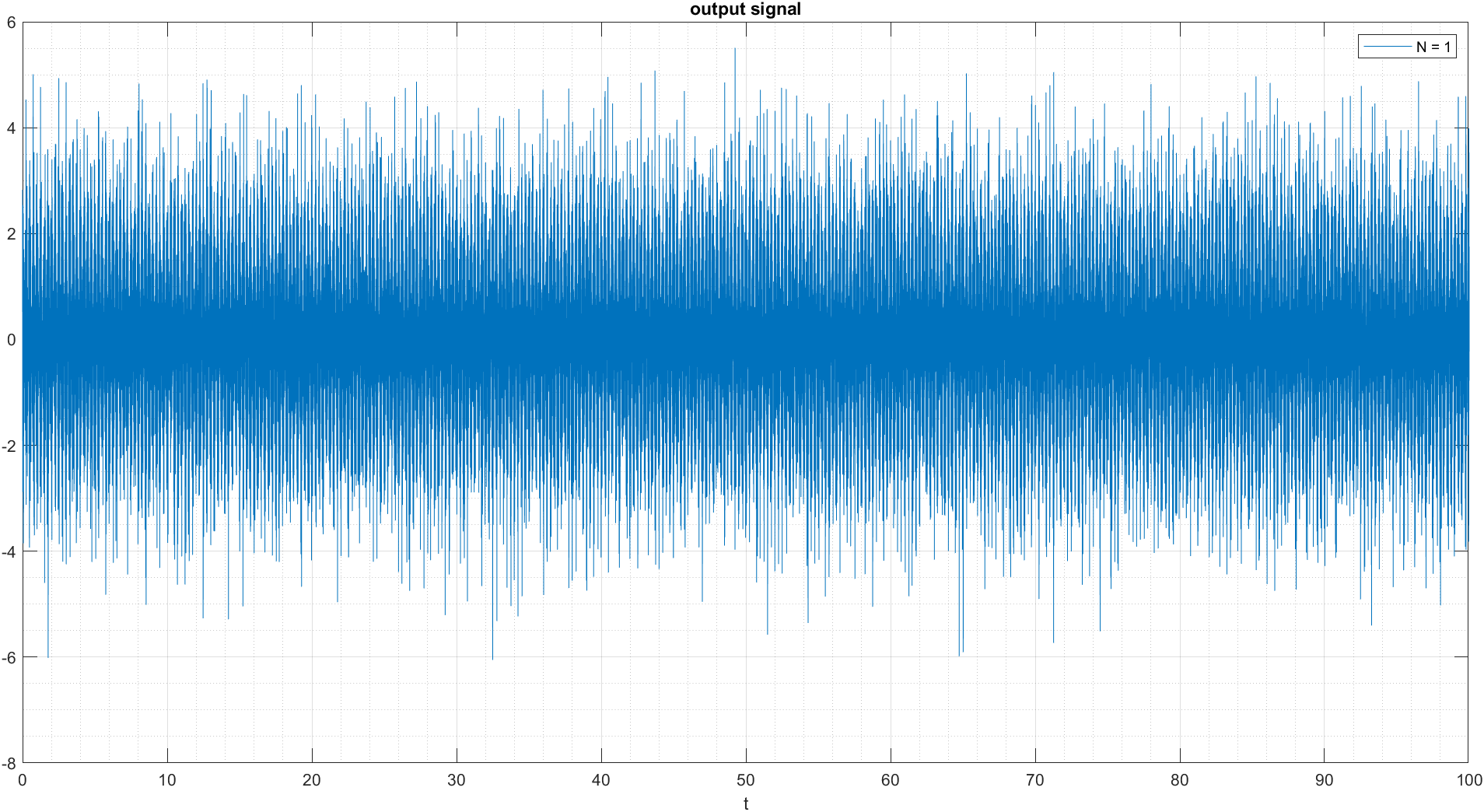
1.3 – By testing different Tm values, we find out that the distance between each two local minimums has a inverse relationship with Tm.

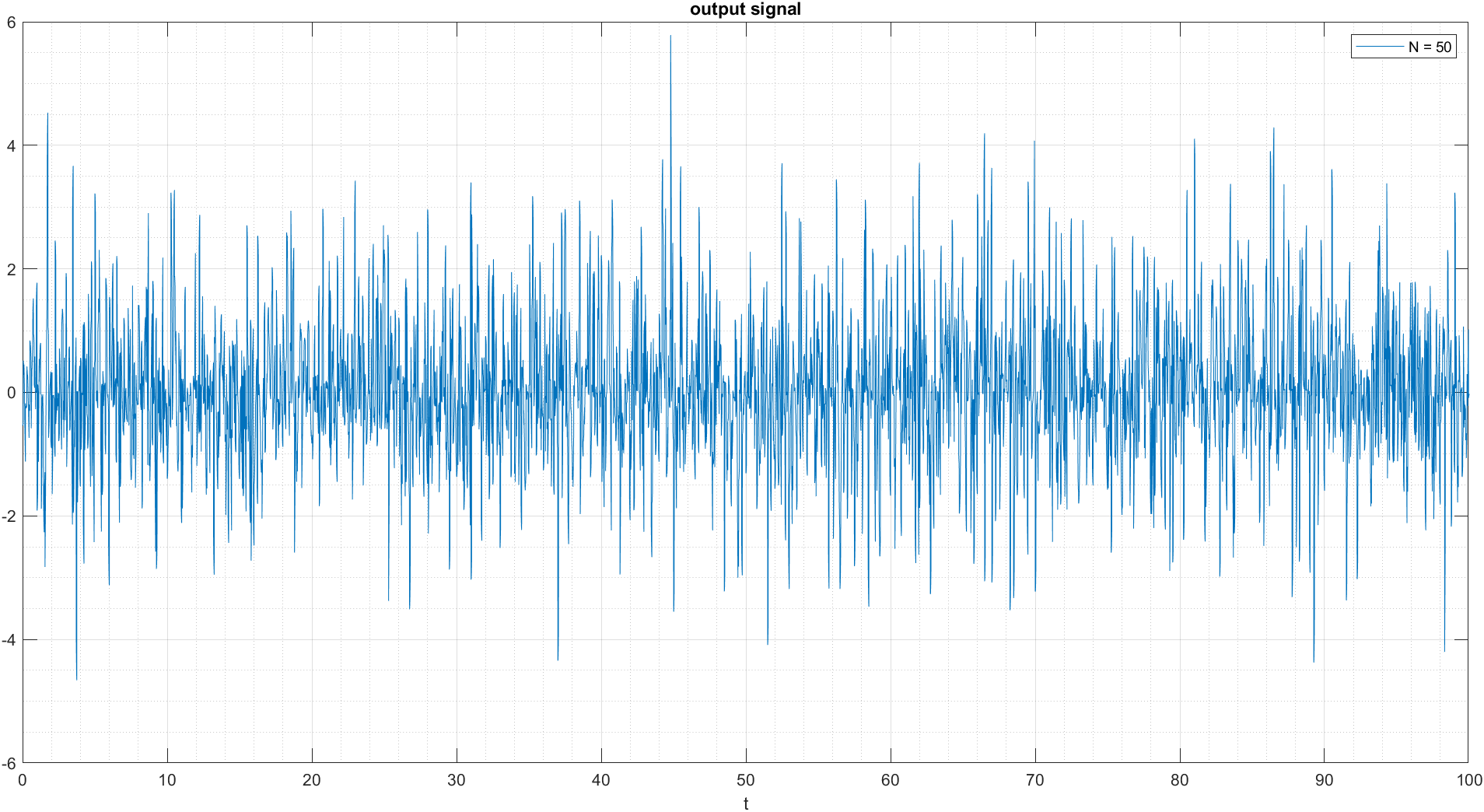


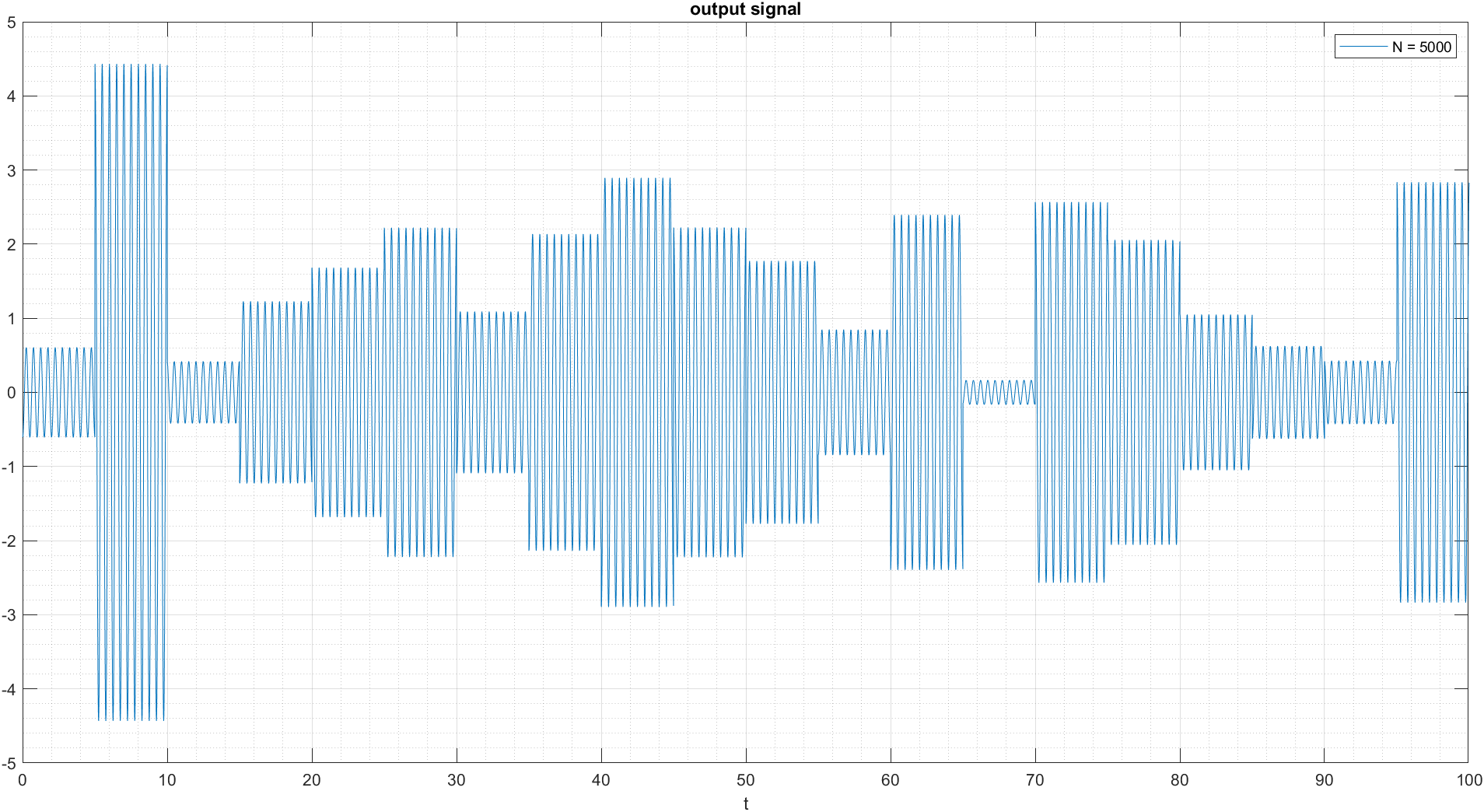
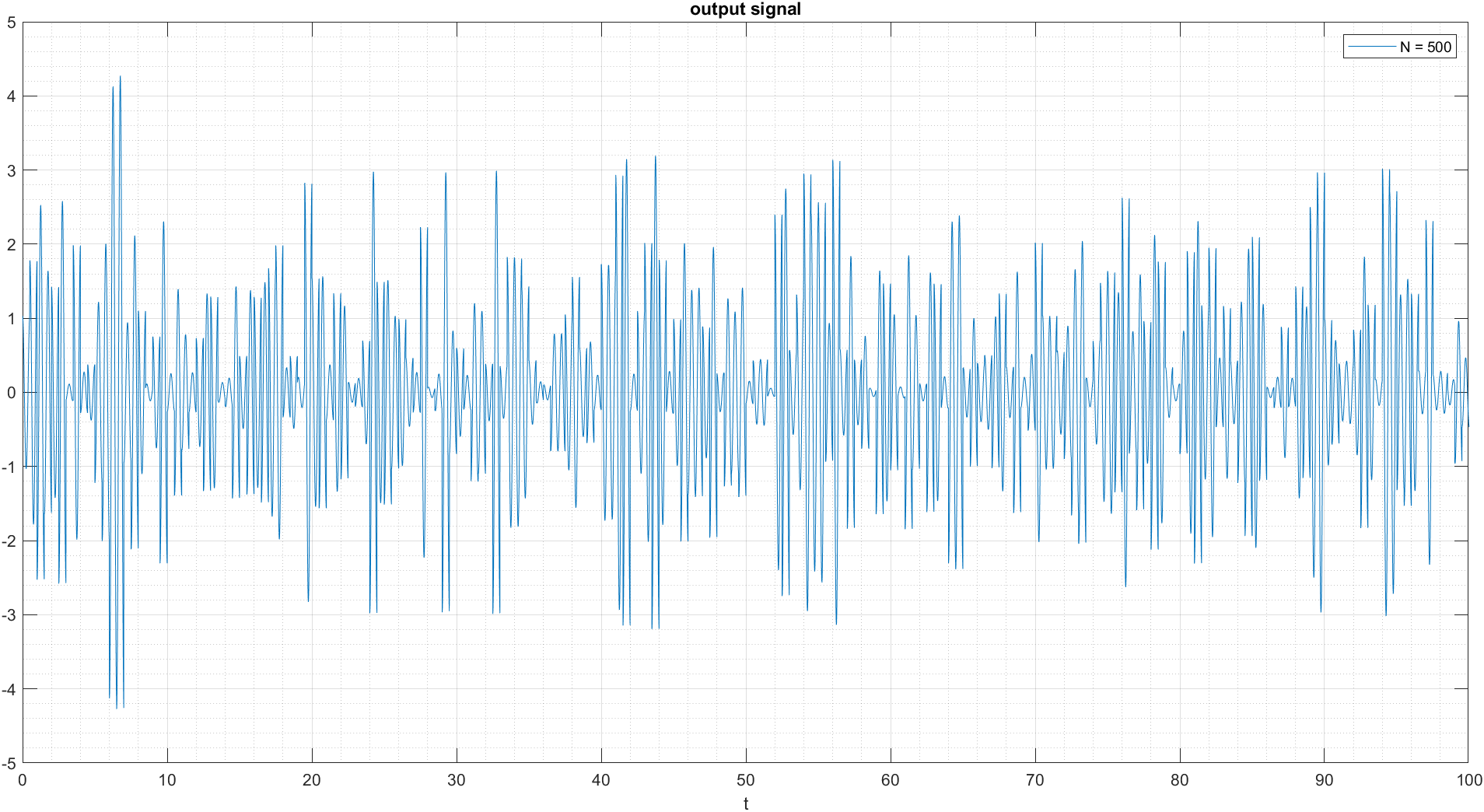


1.4 –

tau = (1/fs).\*randi([0 floor(Tm\*fs)],n); % samples

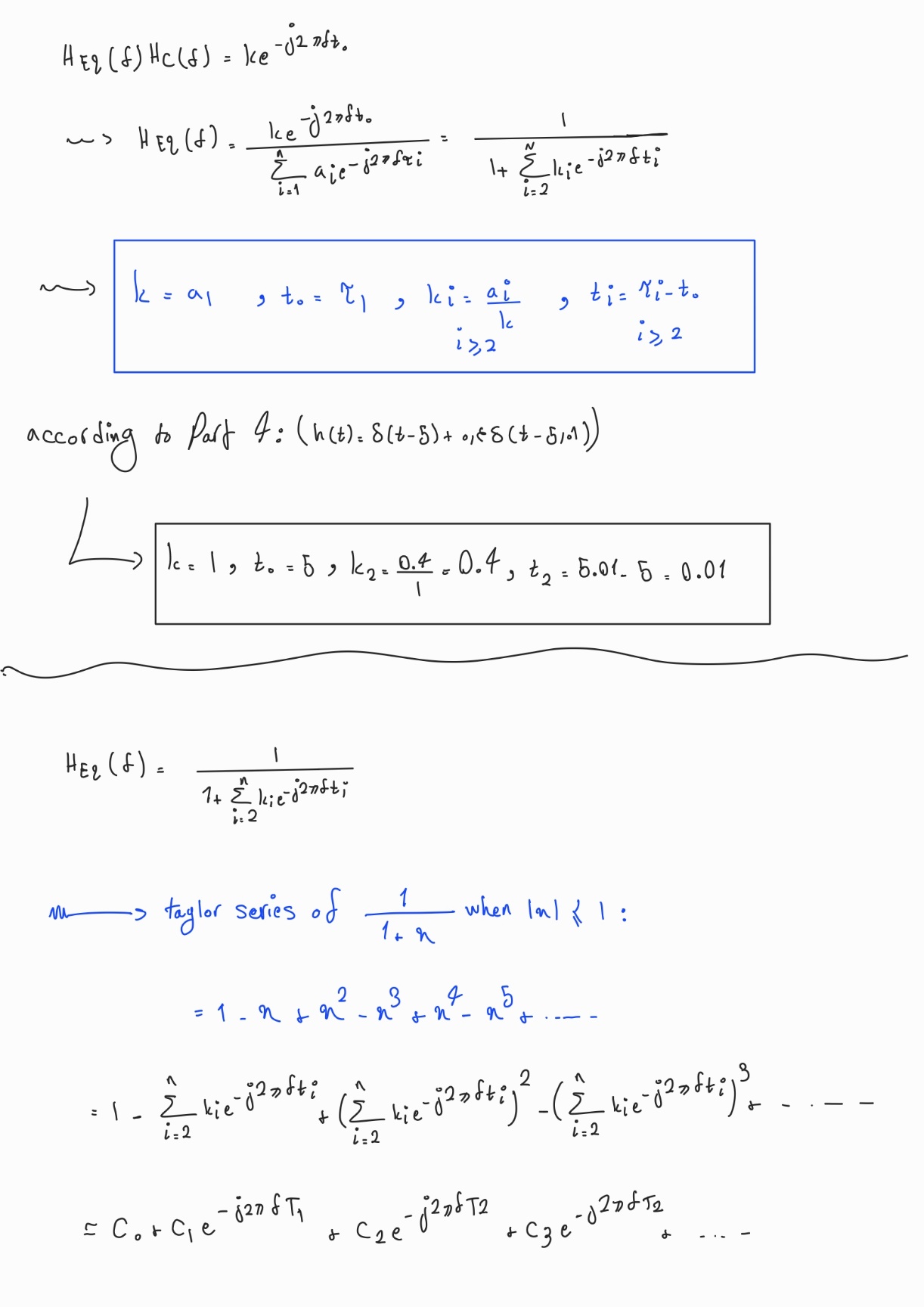


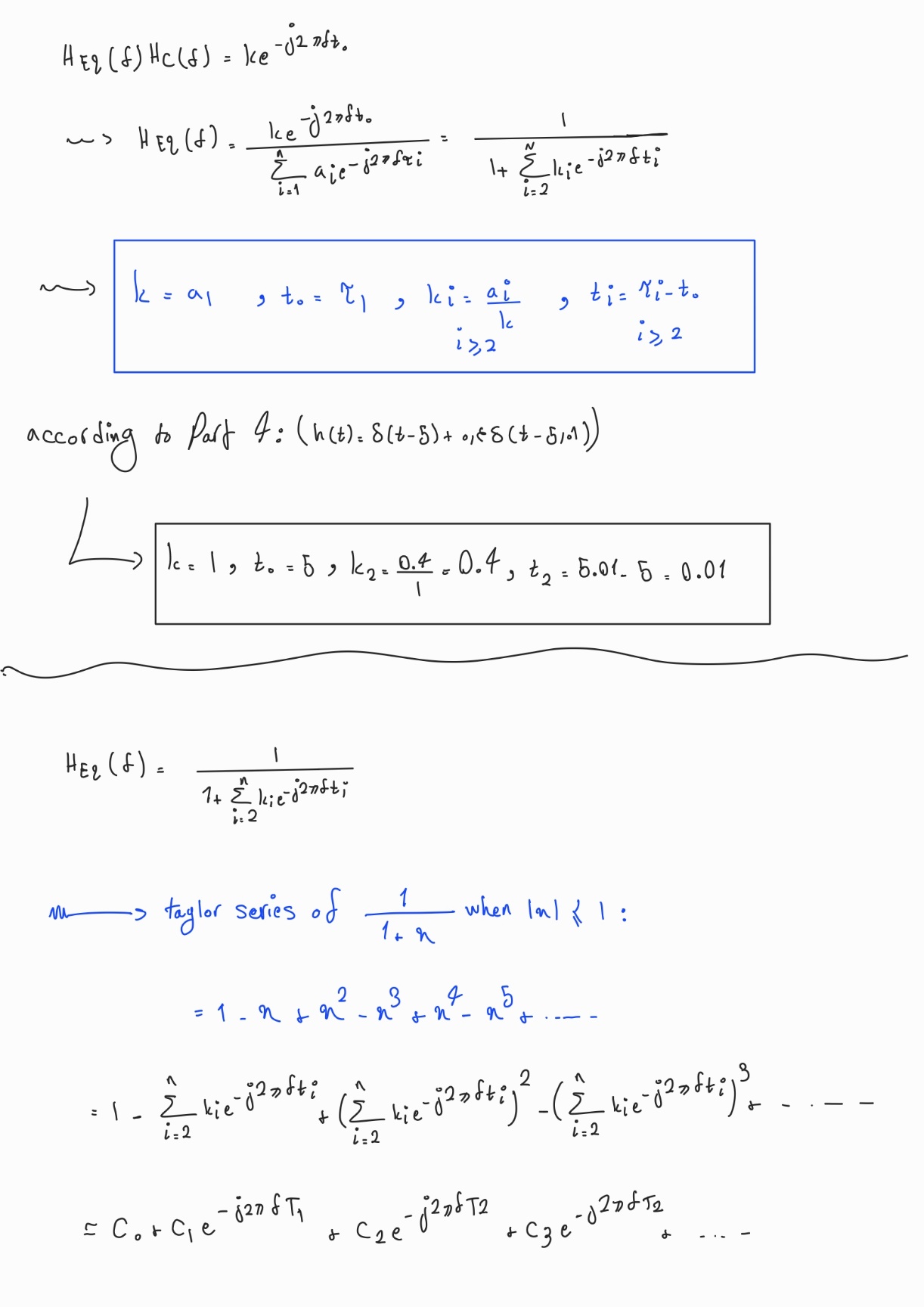




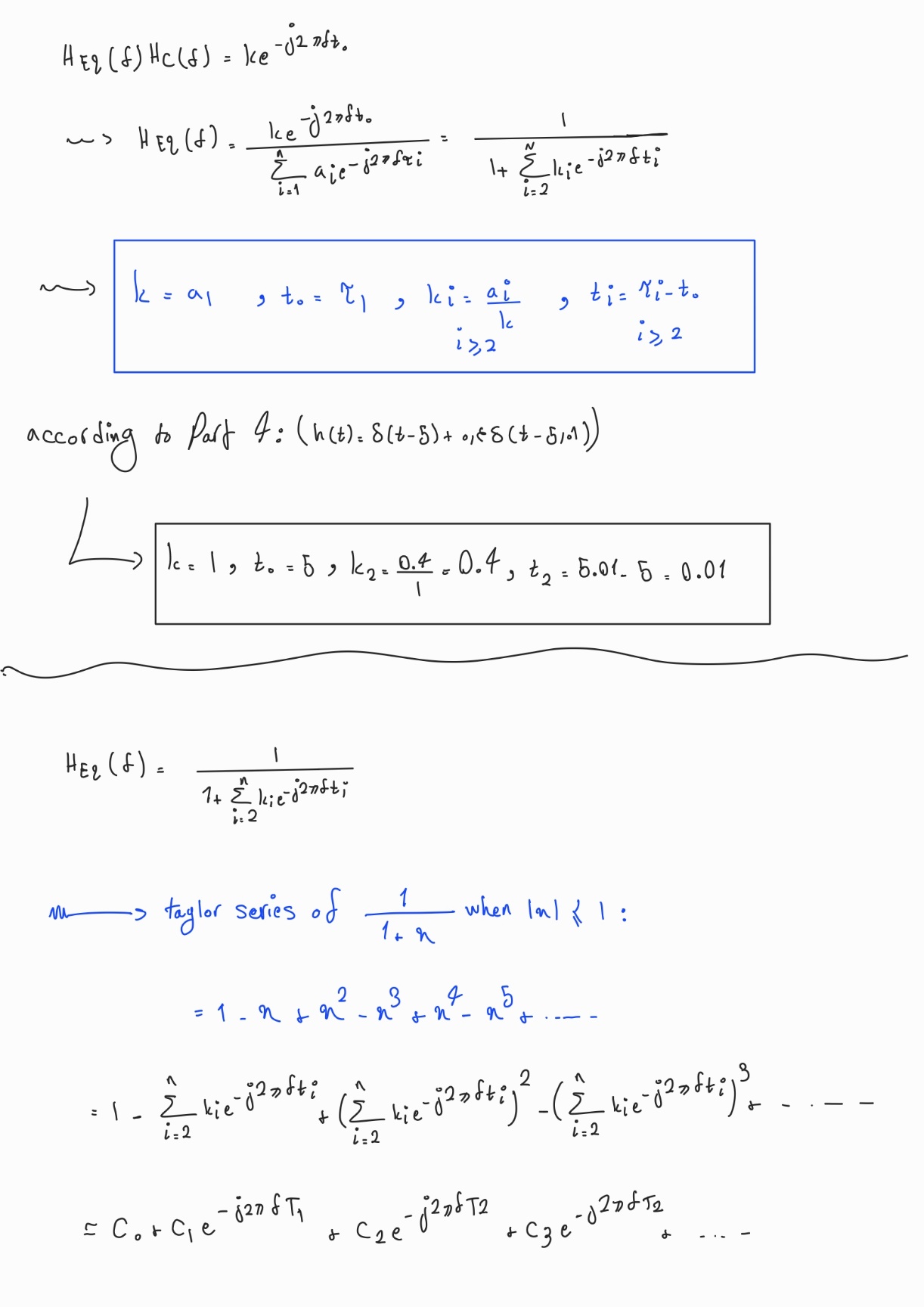
1. Signal Reconstruction in multi path channels:

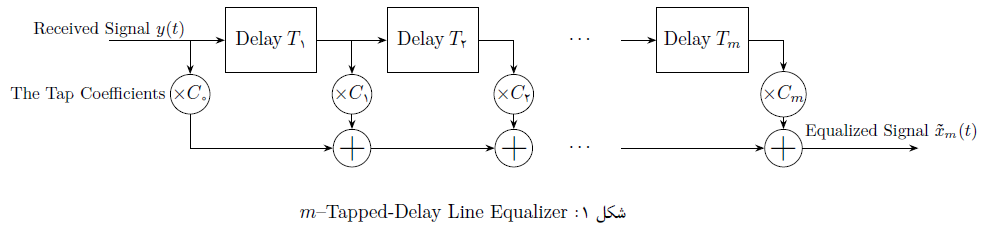
Using M-Tapped-Delay Line Equalizer, the output signal of the multi-path channel will be reconstructed:

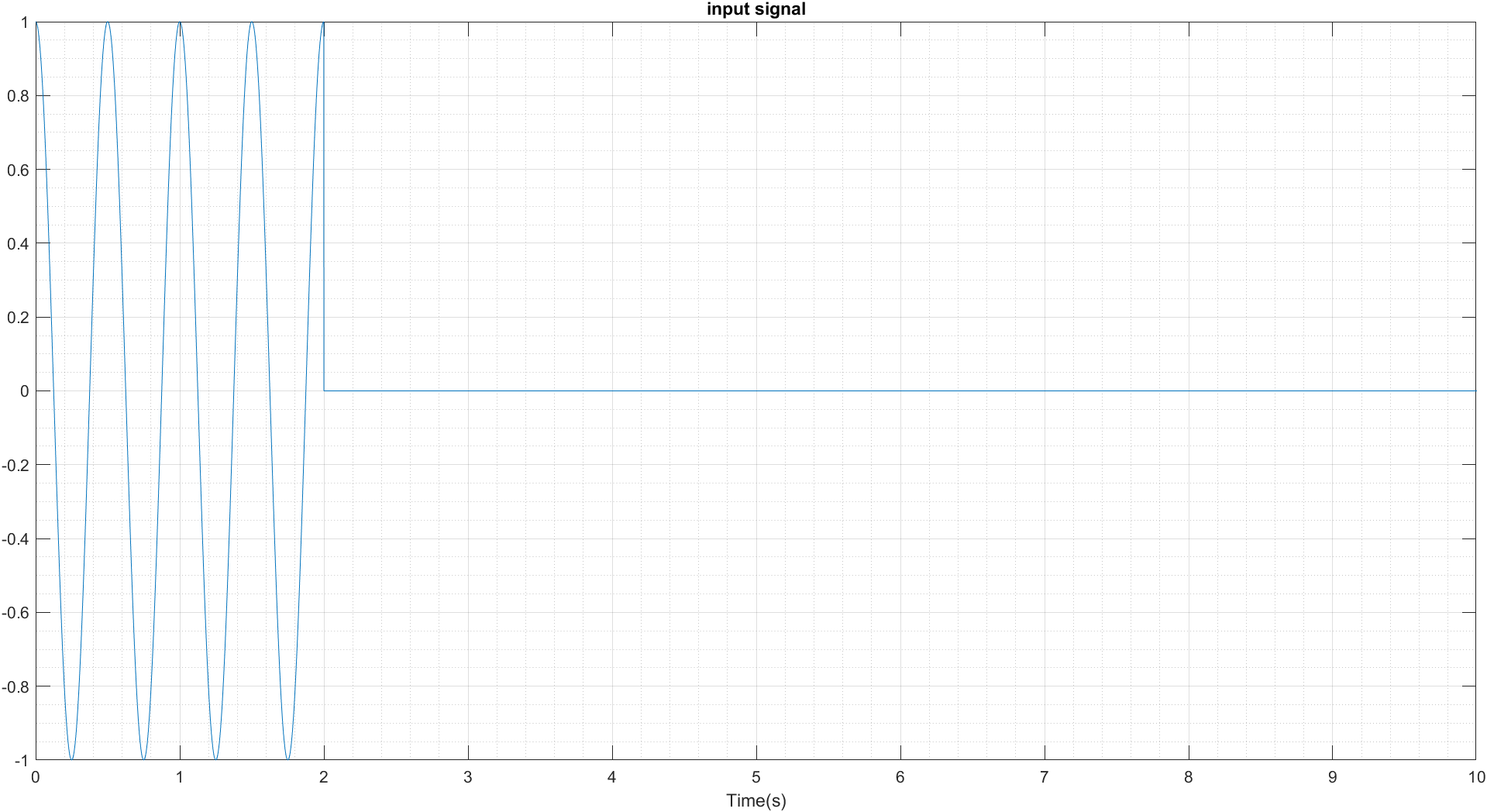
2.1 –

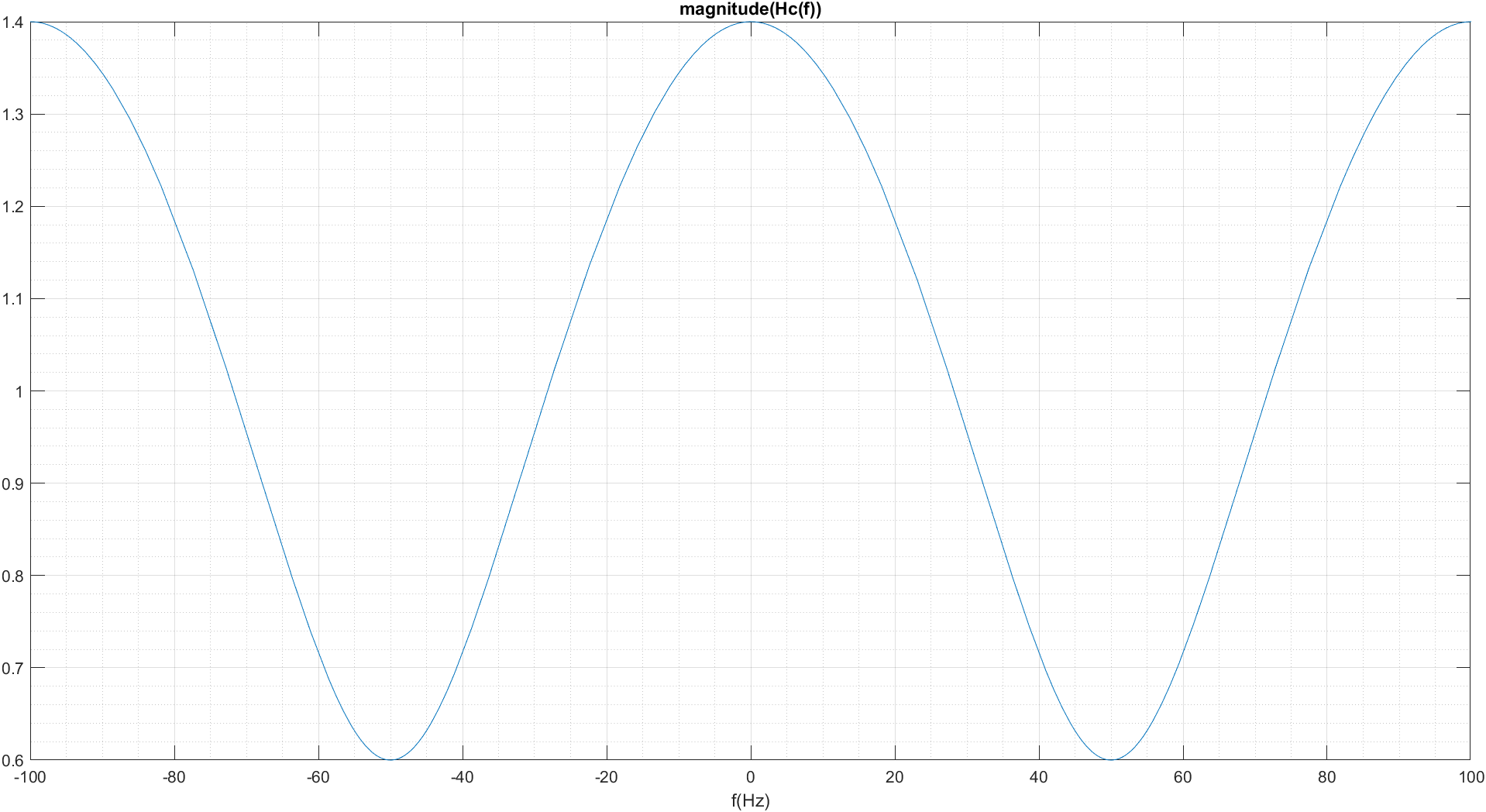


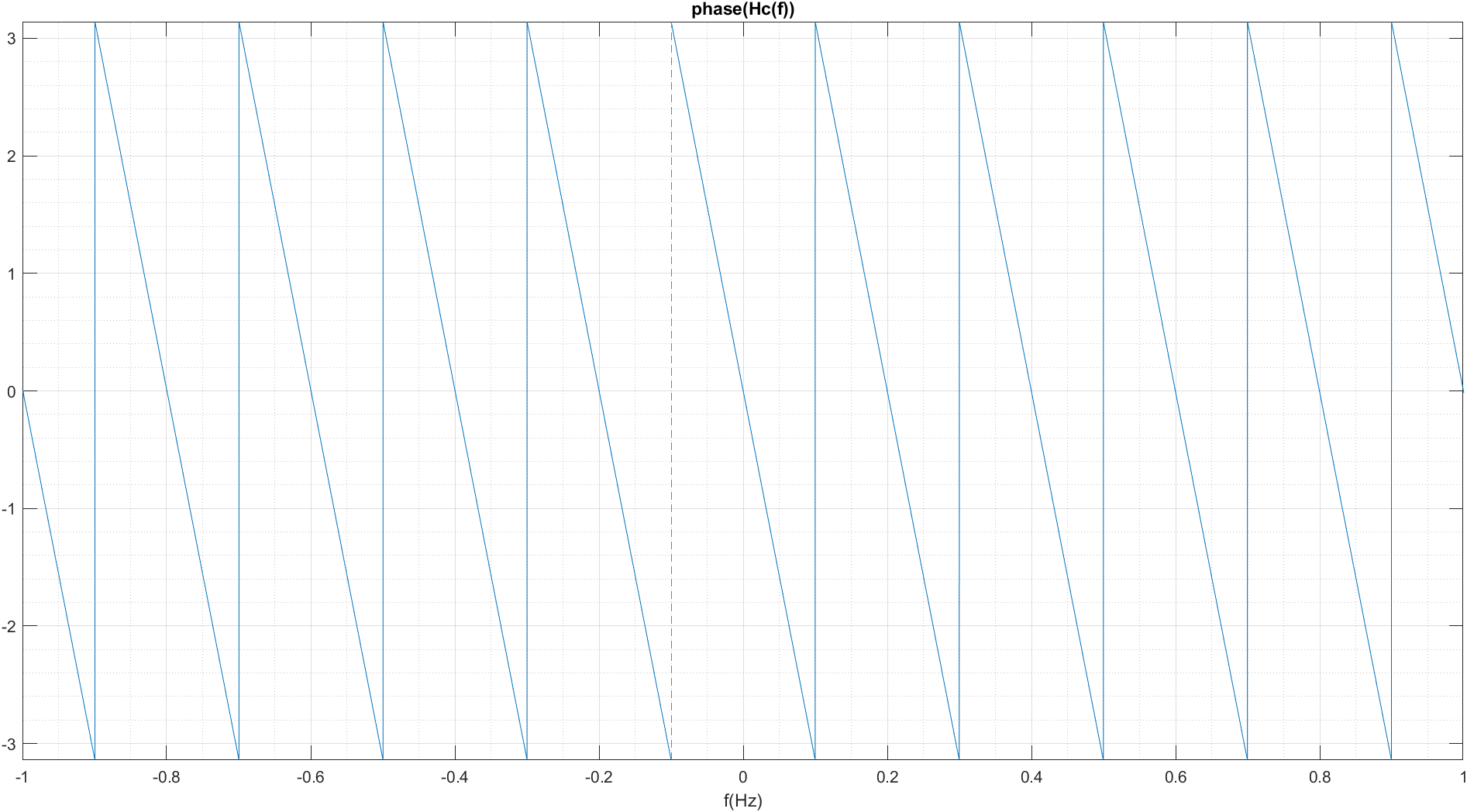
2.2 –



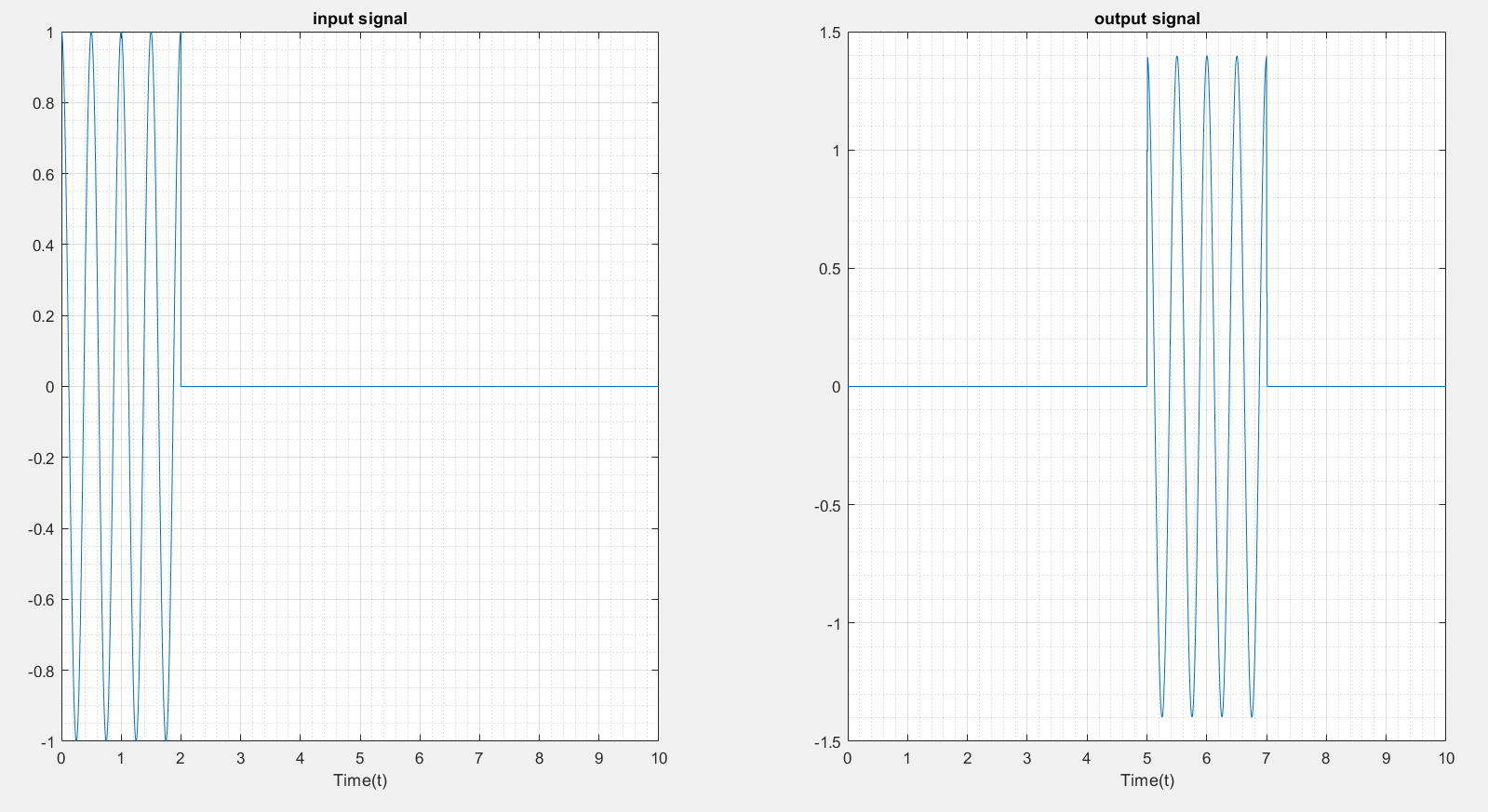


2.3 –

2.4 –



2.5 –



2.6 –

According to part 2.1, Ti and Ci are:

C(i+1) = ((-1)^i)\*((k2)^i);

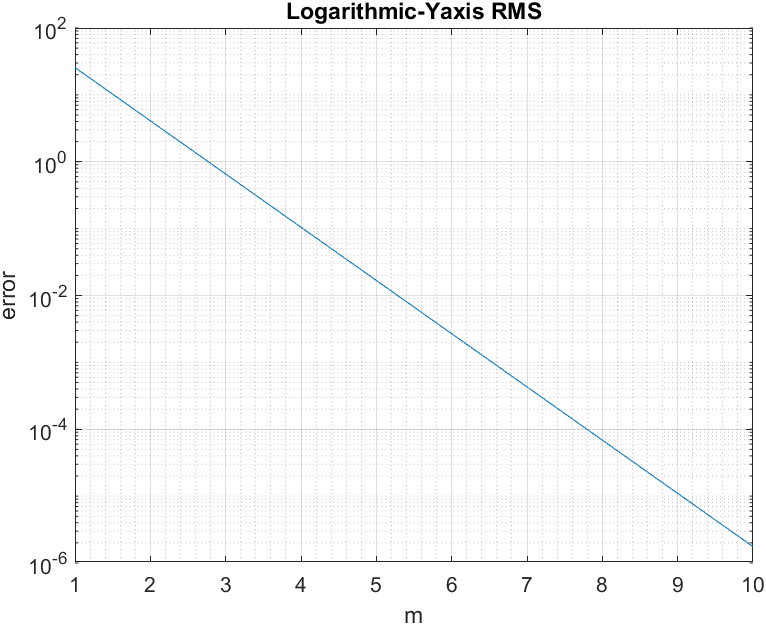
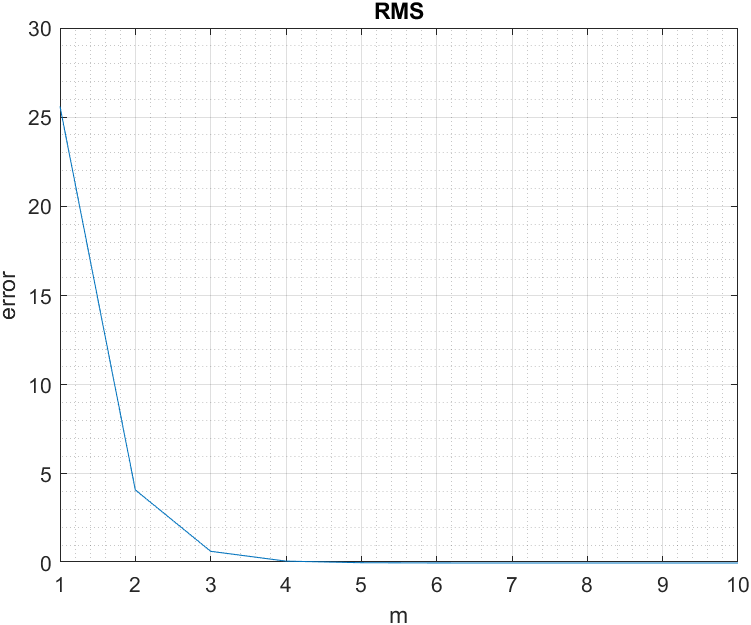
T(i) = t2\*i;

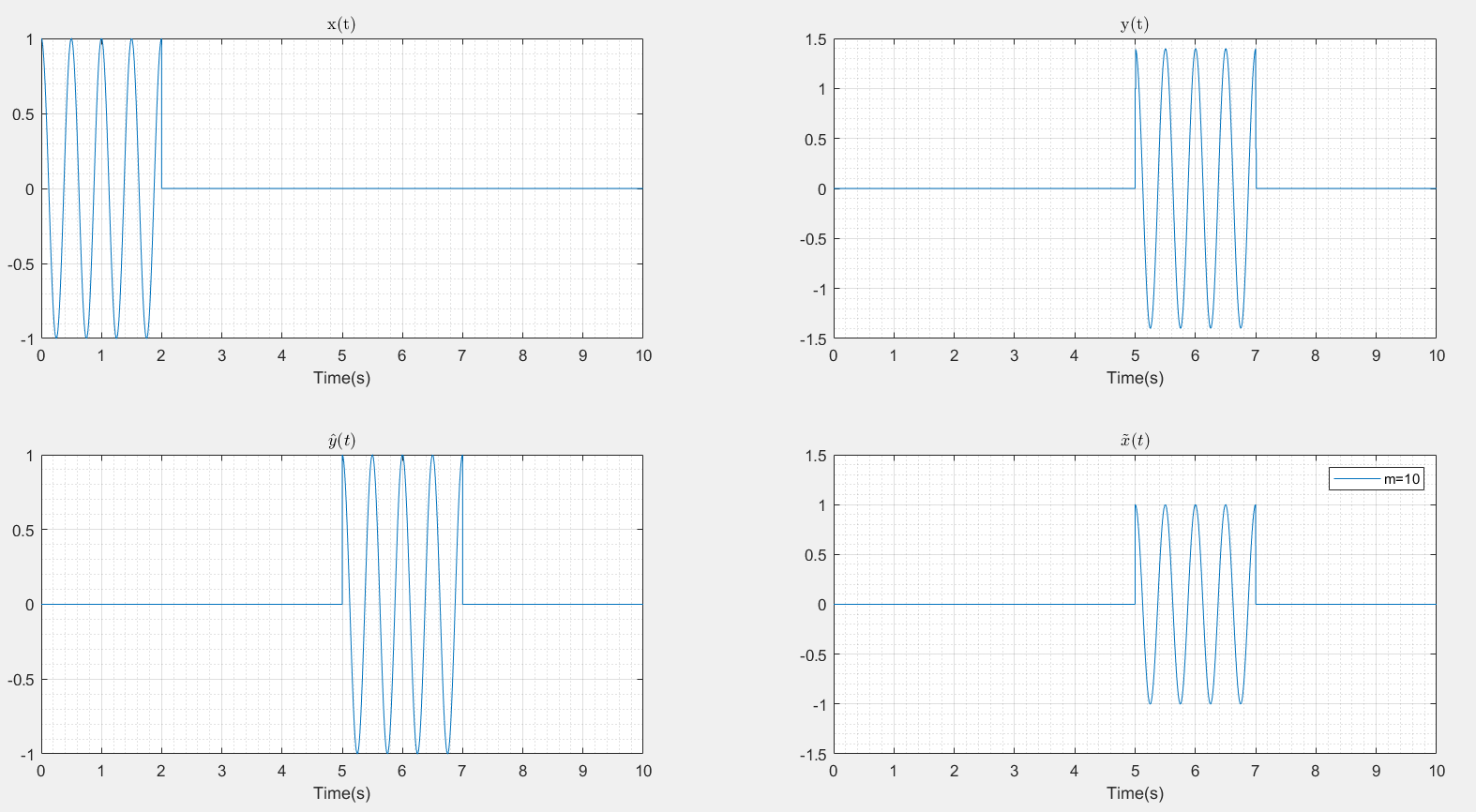
Ci: 

Ti:



As you can see in RMS plots, by increasing m, a better signal would be reconstructed:



2.7 – 

As we see, y(t) which is the output of the multipath channel is destroyed because the domain is changed and if we zoom, there are some impulses on the signal:

but and which are in order, the output of the ideal channel and reconstructed signal are the same and has a low RMS as we saw.