# Low-Rate Time Delay Estimation Matlab Package Instructions

Written by Kfir Gedalyahu and Rami Cohen

The following matlab package contains three main functions:

## Sampling function

[Cn,C]=AnalogSampling(tk,p,h,SNR,SamplingKernel,order)  
The function performs sampling of the output of a multipath channel, probed with Diracs pulses.

Inputs:  
tk - column vector of paths delays in the range [0,1].  
p - number of sampling channels.  
h - gain sequences, the k'th row correspond to the gain sequences of the k'th path.  
SNR – noise level added to the samples.  
SamplingKernel - the sampling kernel used. There are 3 options:  
 'BPF': complex ideal band-pass filters.  
 'LPF': ideal low pass filter.  
 'BLPF': butterworth low pass filter.  
order - Butterworth low pass filter order. Required only when using this kernel.

Outputs:  
Cn- noisy sampling sequences.  
C - non-noisy sampling sequences.

## Reconstruction function

[Aout,tk\_est]=ChanRecover(Cn,K,N,DigDelay,SamplingKernel,order)  
This function recover the channel's parameters from noisy samples.

Inputs:  
Cn - noisy samples.  
K - number of paths.  
N - number of pulses.  
DigDelay - delays of the digital correction filters.  
SamplingKernel - 'BPF': complex ideal band-pass filters.  
 -'LPF': ideal low pass filter.  
 -'BLPF': butterworth low pass filter.  
order - Butterworth low pass filter order. Required only when using this kernel.

Outputs:  
Aout - recovered gain sequences.  
tk\_est - recovered delays.

## Demonstration of the function usages

Run Demo.m for demonstration of the sampling and reconstruction functions usage.