

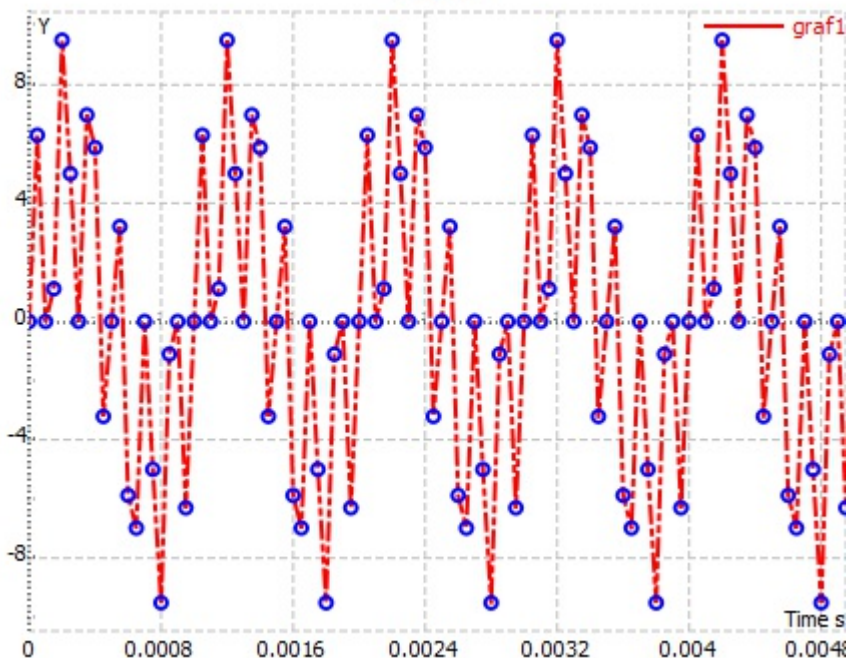
# Signal Decimation - Downsampling

In this example we illustrate the process of signal decimation using existing MatDeck functions. The decimation is the decrease of the sampling rate. First, the test signal is generated. We use the sum of the two sinusoidal signals of different frequencies.

```

Fs := 20000    Hz , sampling rate
Ts := 1/Fs     Sampling period
Dt := curve2d(x , 0 , 0.005 - Ts , 100)
dt := col2vec(Dt , 0)    Time variable
f1 := 1000     Hz
f2 := 6000     Hz
y := 5 sin(2 π · f1 dt) + 5 sin(2 π · f2 dt)    Test signal
graf1 := join mat cols(dt , y)    Graph of the test signal in time domain

```

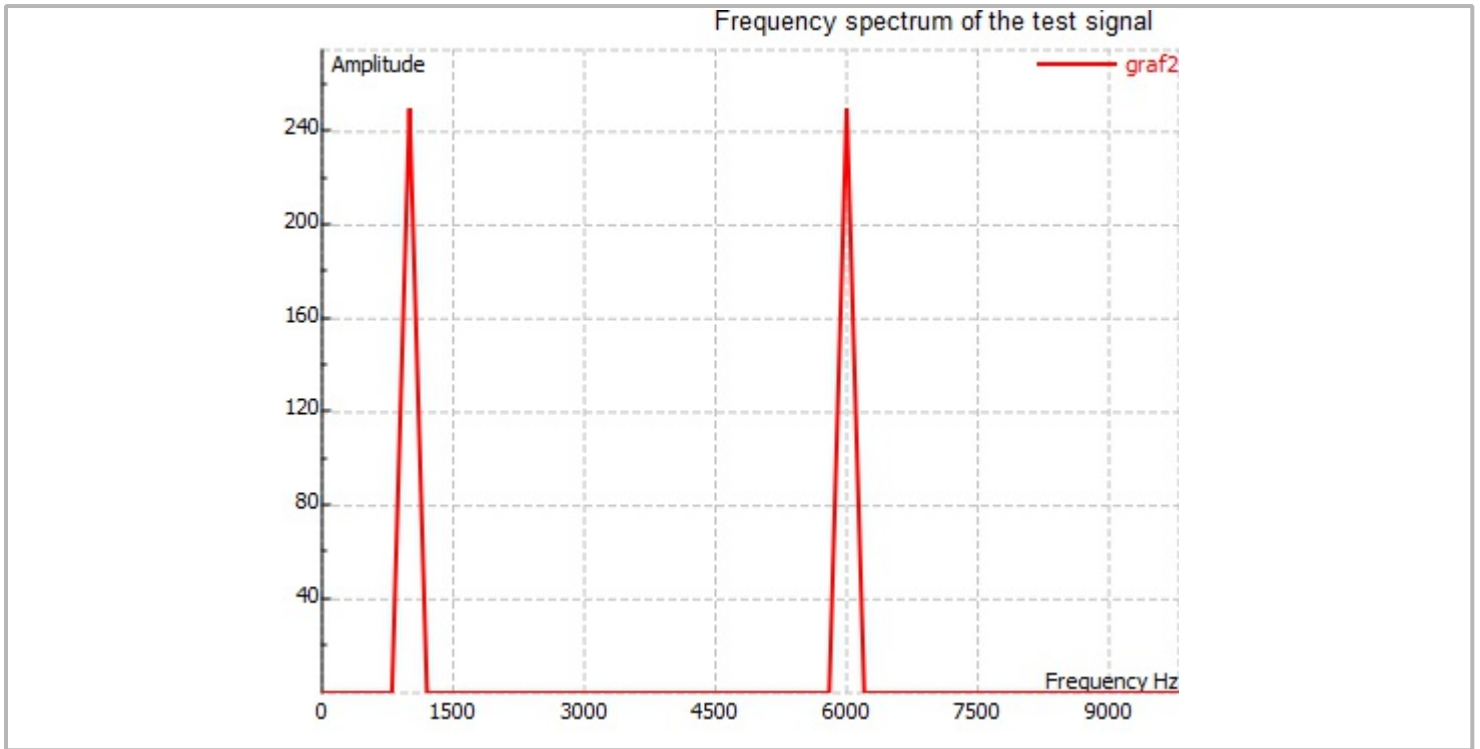


We can investigate the signal spectrum as well. We determine the spectrum by using fft.

```

nfft := size(y)    Length of the test signal
fy := fft1(y)     Spectrum of the test signal
fy1 := subset(fy , 0 , 0 , nfft/2 - 1 , 0)    Only half of the spectrum is needed due to the symmetry
xfft := curve2d(x , 0 , (Fs/2) · (nfft/2 - 1) / (nfft/2) , 50)    Frequency axis
xfft1 := col2vec(xfft , 1)
fyy1 := |fy1|     Amplitude spectrum
graf2 := join mat cols(xfft1 , fyy1)    Graph of the amplitude spectrum of the test signal

```



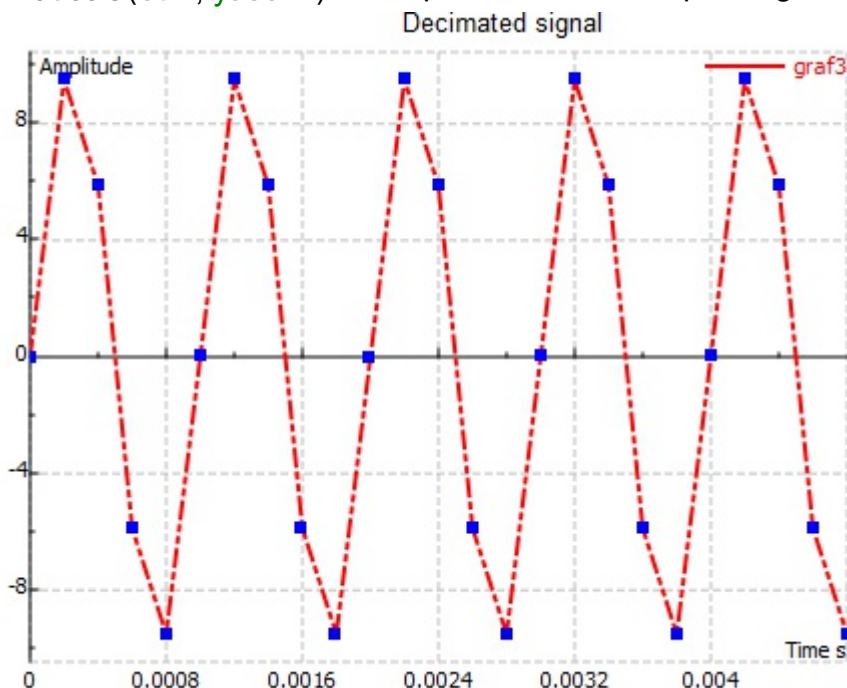
The following task is to decrease the sampling rate by a factor of four, reducing the number of samples. When decimation is performed, one should take care about proper timing, in order to illustrate the decimation.

`N := 4` Downsampling factor

`ydecim := downsample(y, N)` Downsampled signal

`dt1 := downsample(dt, N)` New time axis is obtained by downsampling

`graf3 := join mat cols(dt1, ydecim)` Graph of the downsampled signal in time domain



We can analyze the frequency spectrum of the decimated signal.

`nfftd := size(ydecim)` Length of the downsampled signal

`fydcim := fft1(ydecim)` Spectrum of the downsampled signal

`fy1d := subset(fydcim, 0, 0, (nfftd + 1)/2, 0)` Only half of the spectrum is needed due to the symmetry

`xfftd := curve2d(x, 0, (Fs/(2 N)) * ((nfftd + 1)/2) / (nfftd/2), 14)` New frequency axis

`xfft1d := col2vec(xfftd, 1)`

`fy1d := |fy1d|` Amplitude spectrum of the decimated signal

`graf4 := join mat cols(xfft1d, fy1d)` Graph of the amplitude spectrum of the decimated signal

