Signal Resampling Form

Description

Changing the sampling rate is often needed in many DSP applications, leading to a multirate signal processing. There are two processes. The sampling rate increase means that the number of samples is increased by inserting a zero between existing samples. This process is called interpolation. The sampling rate decreases meaning that the number of samples is decreased by reducing the number of samples. The process is called decimation. MatDeck allows sampling rate to increase and decrease by using Resampling Form.

Example of using Resampling Form

In order to demonstrate the usage of Resampling Form we generate a test signal. The test signal is a sinusoid of low frequency, in order to avoid aliasing effects. Here, the aim is to demonstrate the change of the sampling rate and not the anti-aliasing and anti-imaging effects.

$Fs := 24000$ Hz, sampling rate

$Ts1 := 1/Fs$ s, sampling period

$N1 := 100$ signal length in samples

$dt := \mathrm{ynodes}(t\ ,\ 0\ ,\ (N1 - 1) \cdot Ts1\ ,\ N1)$

$f1 := 1000$ Hz, frequency of sinusoidal

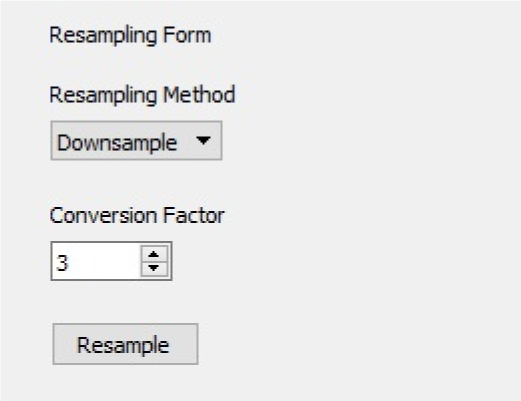
$x := 5\ \sin(2\ \pi \cdot f1\ dt)$

Next, we generate the resampling form. We change, in this case, reduce t sampling rate by a factor of three, therefore decimation is performed. We plot the original signal, and decimated signal in the same graph.

$f := \mathrm{resamplingform}(0\ ,\ \text{"FormR"})$ Generation of resampling form for decimation

$y := \mathrm{resamplingresult}(f\ ,\ x)$ Obtaining result of decimation by using the form

$dty := \mathrm{ynodes}(ty\ ,\ 0\ ,\ (\mathrm{size}(y) - 1) \cdot Ts1 \cdot 3\ ,\ \mathrm{size}(y))$ Time axis for interpolated signal



Resampling Form

Resampling Method

Downsample ▼

Conversion Factor

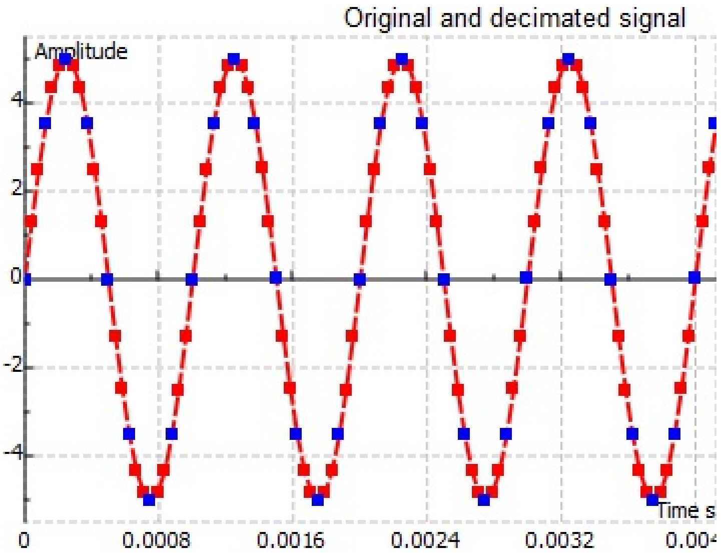
3

Resample

$graf1 := \mathrm{join\ mat\ cols}(dt\ ,\ x)$ Graph of original signal

$graf2 := \mathrm{join\ mat\ cols}(dty\ ,\ y)$ Graph of decimated signal

The sampling rate increases, which is either interpolation or upsampling, for a factor of three is performed by inserting two zeros between existing samples. In the following we generate the second resampling form in order to perform interpolation by three. We also prepare the time axis for the interpolated signal and we show the results together with the original signal.

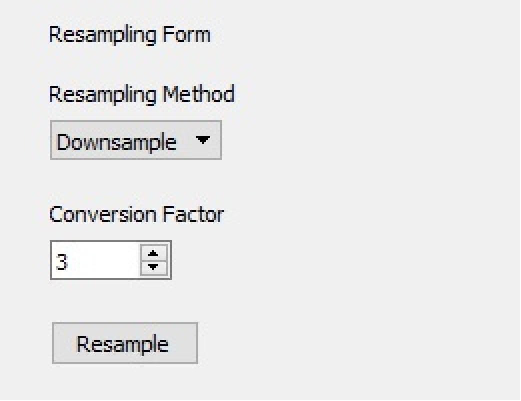


Interpolation operations

f1 := resamplingform(0 , "FormRI")   Generation of resampling form for interpolation

y11 := resamplingresult(f1 , x)   Obtaining result of interpolation by using the form

dty1 := ynodes(ty1 , 0 , (size(y11) - 1) · Ts1 · 3 , size(y11))   Time axis for interpolated signal


Resampling Form

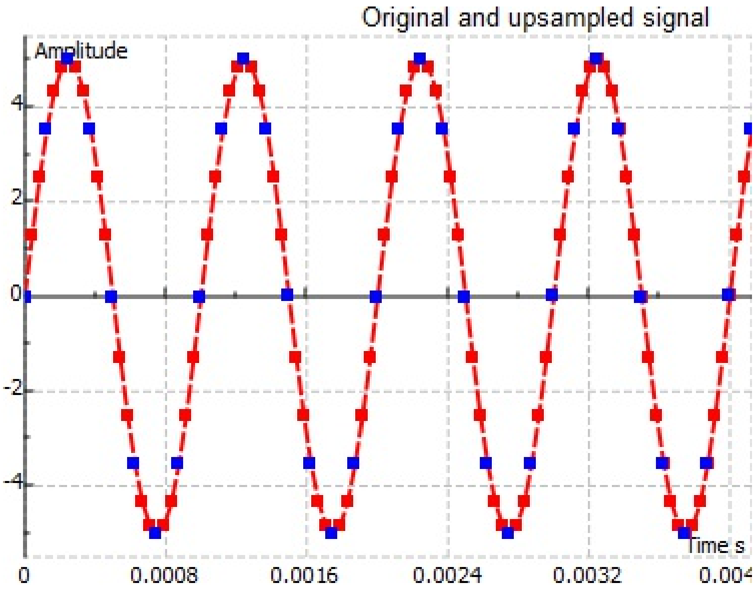
Resampling Method

Downsample ▾

Conversion Factor

3

graf3 := join mat cols(dty1 , y11)   Graph of upsampled signal


Original and upsampled signal
Amplitude
Time s