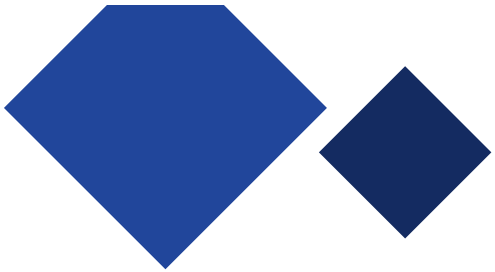
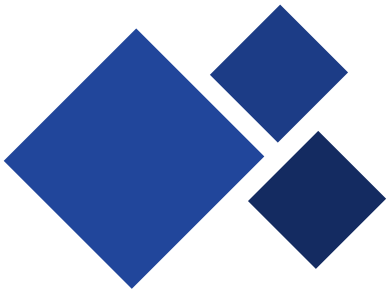


Lecture 11

Convolution and Fourier series in MatLab

Tomaso Erseghe



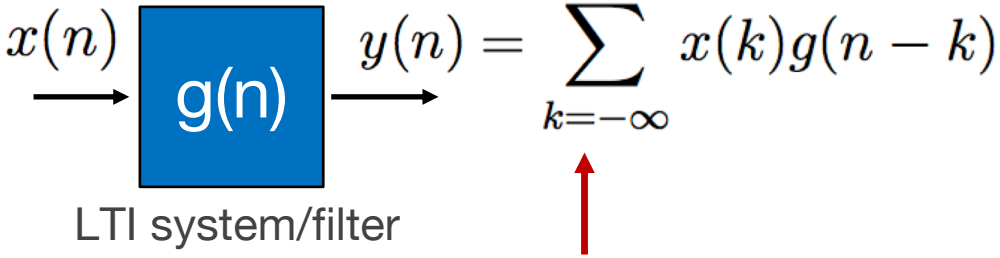
11.1 Convolution in MatLab

An overview

- Discrete-time convolution
- Approximate convolution in continuous-time

Discrete-time convolution

For limited-time signals

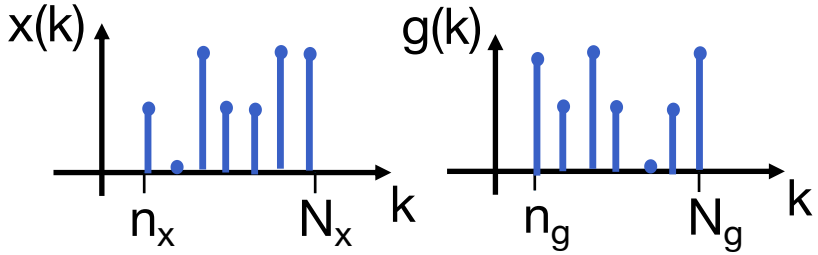


$$y(n) = \sum_{k=-\infty}^{\infty} x(k)g(n-k)$$

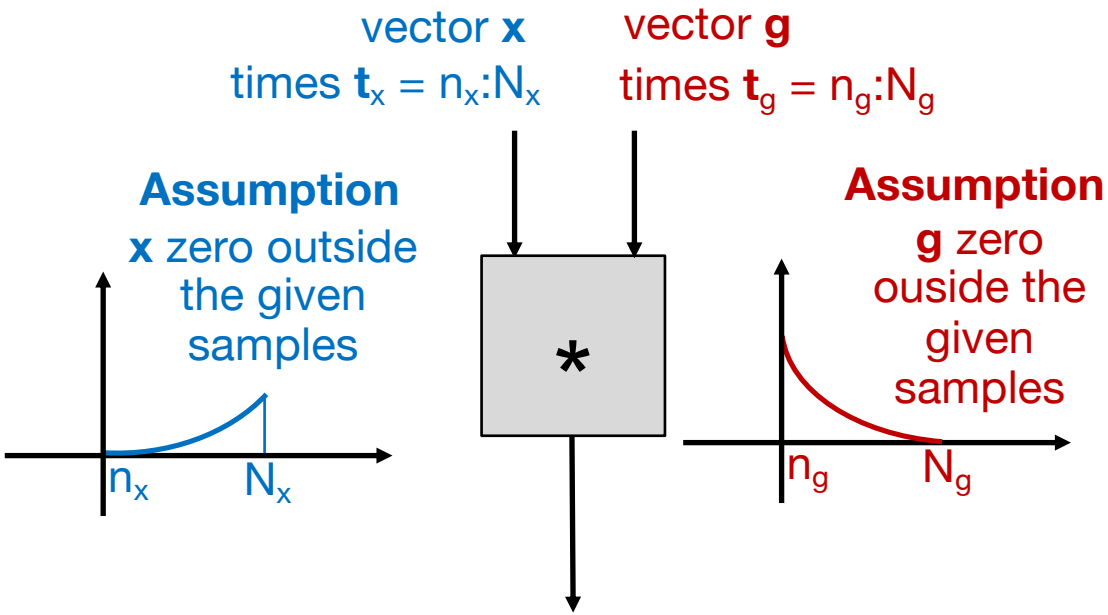
LTI system/filter

Limited only if limited signals

$e(x^*g) = [n_x+n_g, N_x+N_g]$

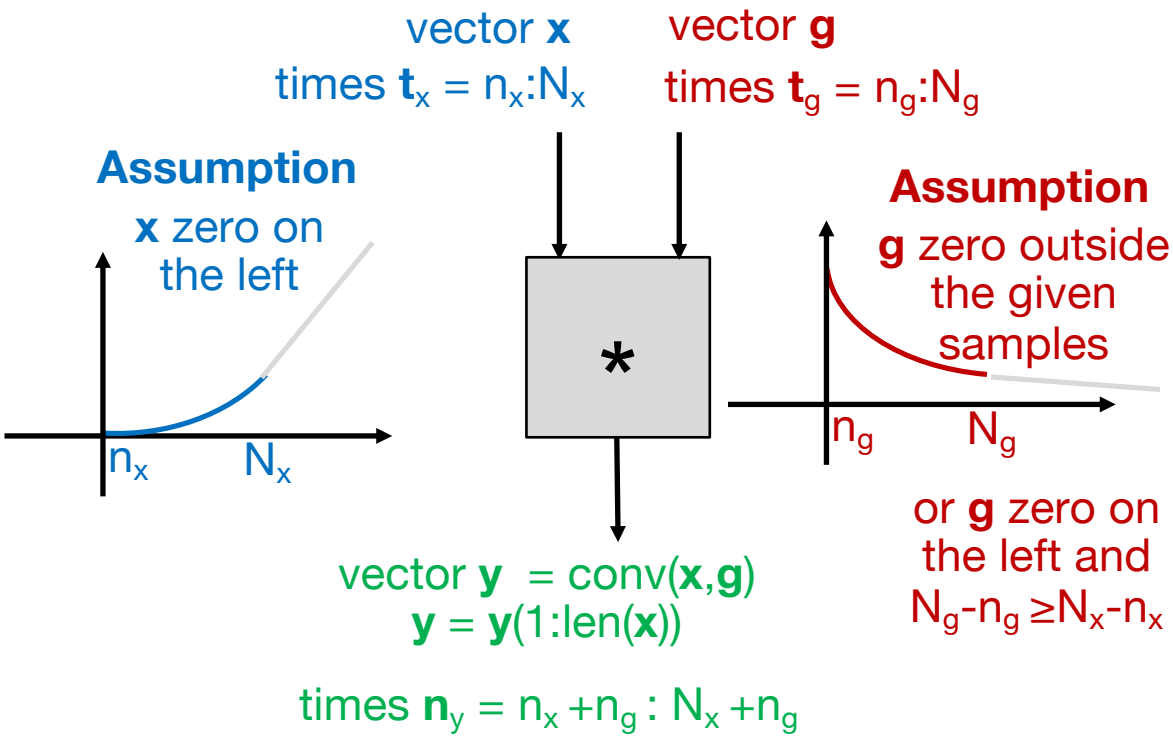


MatLab conv function



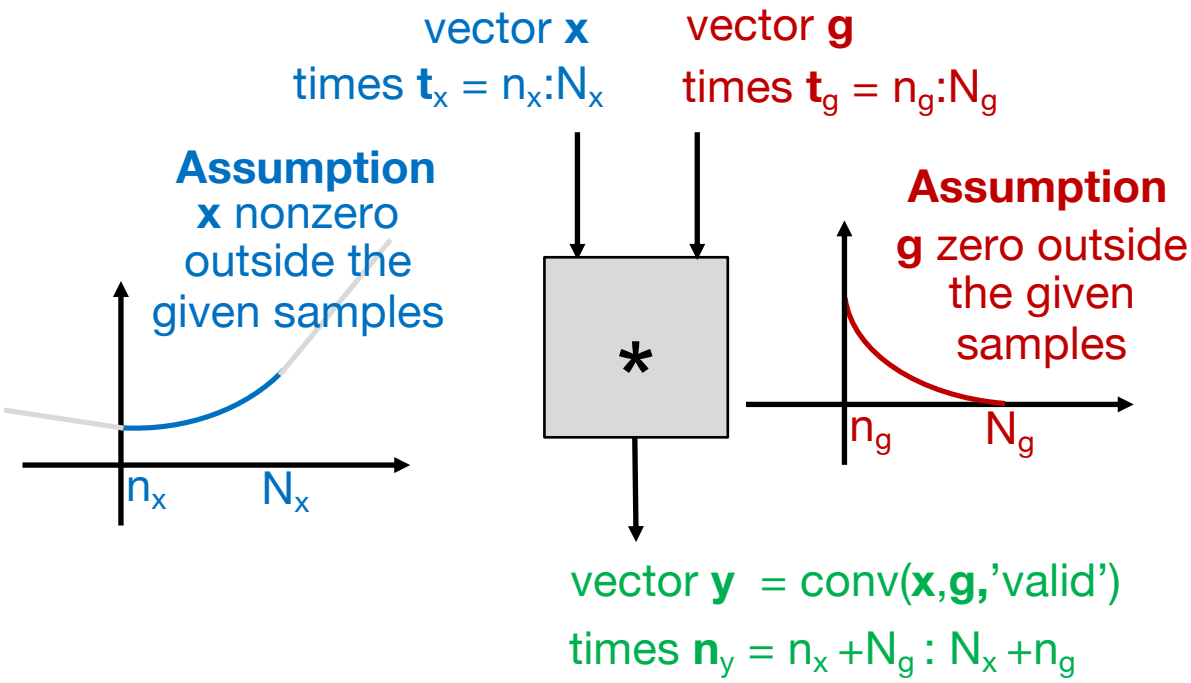
MatLab conv function

cut the result in case nonzero outside



MatLab conv function

‘valid’ = keeps an even smaller part



Continuous-time convolution

An approximation

samples of y

$$x * g(nT) = \int_{-\infty}^{\infty} x(u)g(nT-u)\,du$$

$$\simeq T \sum_{k=-\infty}^{\infty} x(kT)g(nT-kT)$$

sampling spacing: must be sufficiently (very) small

samples of x and g

y = T*conv(x,g)

$t_y = t_x + t_g : T_x + T_g$

Exercises

On the convolution in MatLab

Get acquainted with MatLab convolution operator **conv** and remind that when approximating a continuous-time convolution you will need to multiply by the sampling spacing T, to have **T*conv(x,g)**

Remember that the output of the convolution is not always valuable everywhere, e.g., in case signals are not zero outside the interval where samples are given

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