

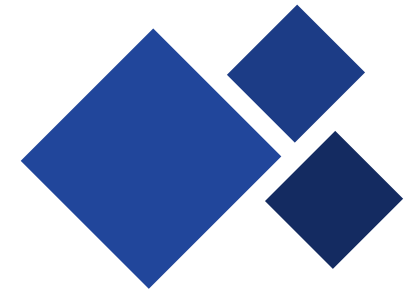


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Lecture 18

Fourier transforms in MatLab

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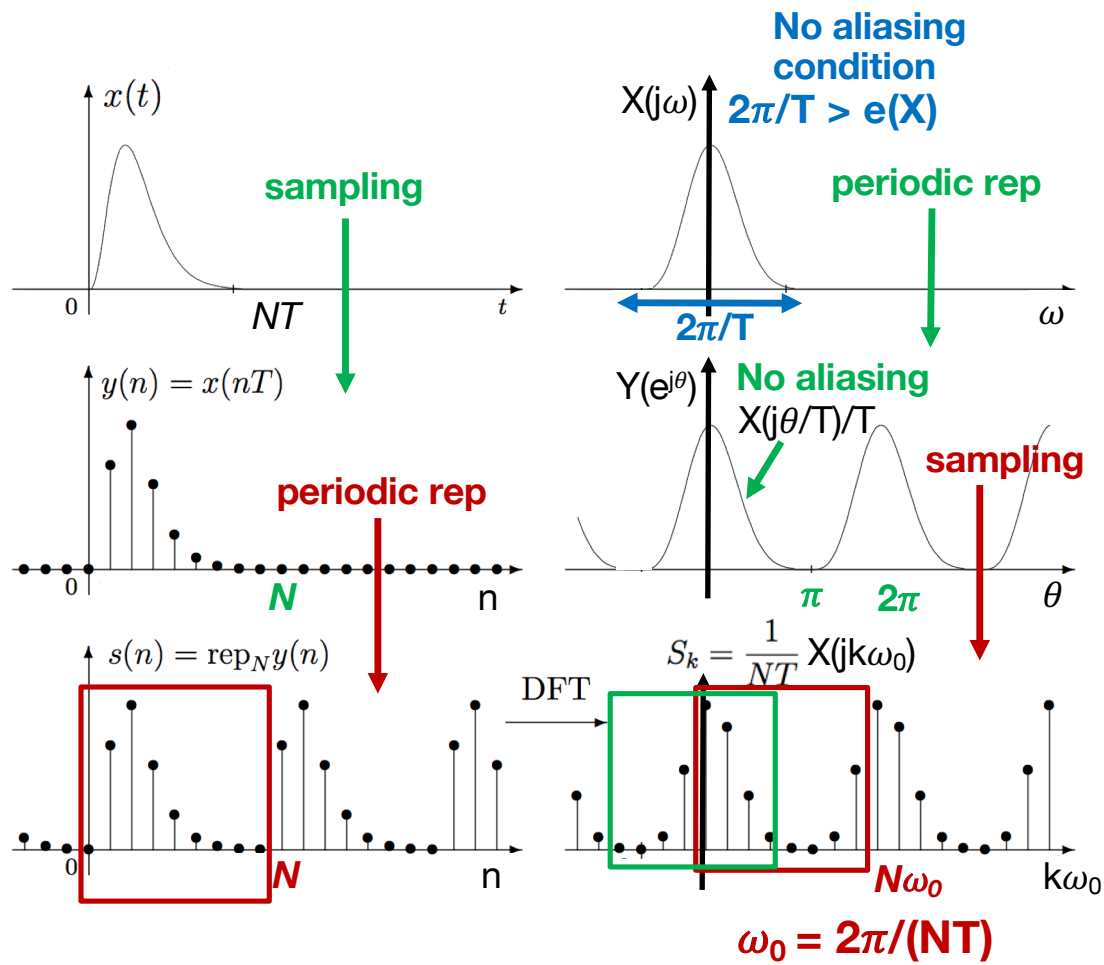


18.1 The Fourier transform in MatLab

An overview

- ◆ Sampled signals and DFT
- ◆ The fft and fftshift functions

The Fourier transform



MatLab fft function

From time to Fourier samples

x % signal samples

T % sampling spacing

N = length(x); % samples length

t = (0:N-1)*T; % time samples

X = ifftshift(T*fft(x)); % Fourier samples

$\omega = (-\text{round}((N-1)/2):\text{round}(N/2)-1) * 2*\pi/(N*T);$
% pulsations (in a period)

$-N/2:N/2-1$
N even

$-(N-1)/2:(N-1)/2$
N odd



Corrections for time-samples

Using the time-shift dual

x % signal samples

T % sampling spacing

N = length(x); % samples length

t = (0:N-1)*T + t₀; % time samples starting at t₀

X = ifftshift(T*fft(x)); % Fourier samples

ω = (-round((N-1)/2):round(N/2)-1) *2*pi/(N*T);
% pulsations (in a period)

X = X .* exp(-1j*ω*t(1)); % Modulation effect



Exercises

On the Fourier transform in MatLab

Get acquainted with MatLab Fourier operators `fft` and `fftshift` and learn how to correctly calculate Fourier transforms.

Check that you get the analytical expression of the Fourier transform for known signal couples.





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