Lectures for semester 1
Course Module : Digital Signal Processing
End course exam, December 12th 2016
1.5 hours, documents not allowed but calculators allowed
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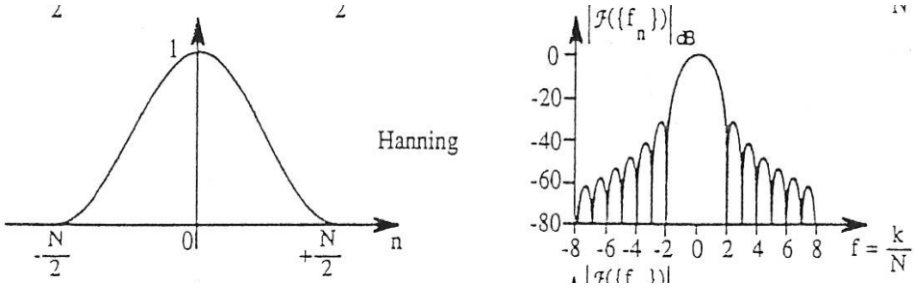
I. We will consider the Hanning window whose expression in continuous-time domain stands as:
For $t \in [-T/2; +T/2 [$, $v(t) = [1 + \cos (2 \pi t / T)] / 2$.

Elsewhere, $v(t) = 0$.
In addition, we consider $T = N = 8$ seconds for numerical applications.

a. Draw v(t) in time domain. Is v(t) a finite-time duration signal? Is it an even signal?
b. Calculate the Fourier transform $\underline{V}(f)$ of v(t). Explain why its phasis is zero and draw its magnitude vs frequency f. Explain the width of the main lobe and compare to the figure below (right part).



c. We now shift v(t) towards the right by T/2 and sample $x(t) = v(t - T/2)$ by choosing $N = 8$ samples. Give the 8 values of x(i) for i = 0 to 7.
d. We now quantize x(i) by rounded-method with the quantization step $q = 1/255$ and 8 bits (each x(i) is represented by a byte). Give the eight bytes for $x_q(i)$, for i = 0 to 7.

II. We consider the discrete-time signal on 8 samples
y(i) = { 0; 0.146; 0.5; 0.854; 1; 0.854; 0.5; 0.146 }.
a. Give the matrix expression allowing to calculate the FFT Y(k) of signal y(i).
b. Calculate Y(0), Y(2), Y(4), Y(6).
c. Calculate Y(1), Y(3), Y(5) and Y(7)…
d. Compare your results with the right part of the above figure.
e. Check on this signal y(i) the Parseval's identity.