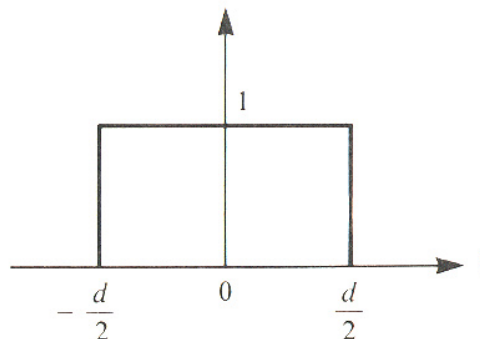


Ch471
W '07

Fourier Transform and Convolution Problems

1. (a) Calculate the Fourier Transform of a boxcar (rectangular) window used in FTIR to sample the interferogram without apodization. Plot the result in Excel. This theorem might prove useful: $e^{-i\phi} = \cos\phi - i\sin\phi$.

$$f(t) = \begin{cases} 1, & |t| < d/2 \\ 0, & |t| > d/2 \end{cases}$$



- (b) What is the Fourier Transform of a triangle function (no calculation)?
(c) Plot it in Excel.
2. (a) Compare boxcar vs. triangular apodization in terms of appearance of FTIR spectral peaks, sensitivity (LOD), and resolution.
(b) What other types of windows are there and what are their properties?
3. (a) What is a Delta (impulse) function and how is it mathematically defined?
(b) What is its transform pair?
(c) How is it applied in sampling theory?
4. (a) State the two convolution theorems used in class.
(b) Which one was used in digital filtering?
(c) Which one was used in apodization?
(d) Outline the process of digital filtering and apodization using a noisy sine wave and interferogram respectively. Draw figures to illustrate your explanation.