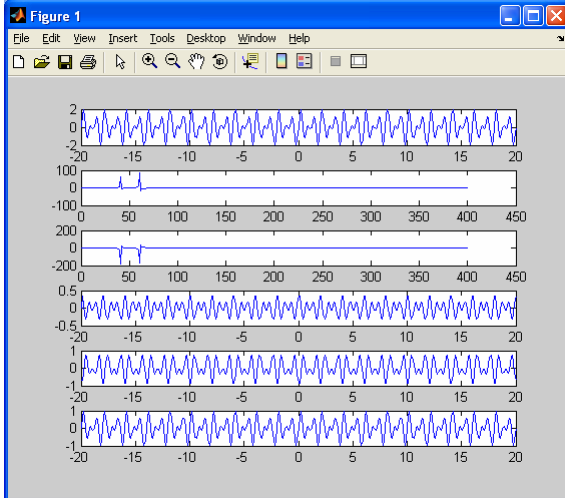


Physics 640
September 20, 2007

Today we had the presentations on Project 1. Towards the second half of the class, a more relaxed and cordial atmosphere was achieved, with more questions and interactions that are high encouraged in this course. We hope there will be even more team interactions in Project 2.

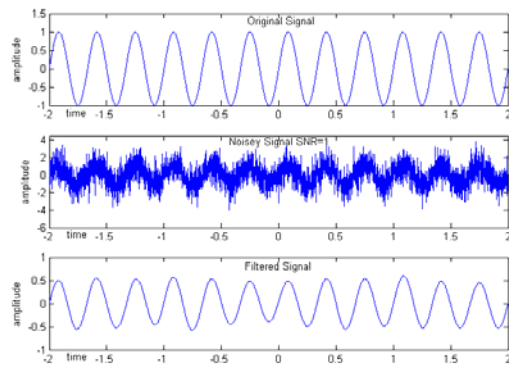
Some figures submitted as results of Project 1

Part a

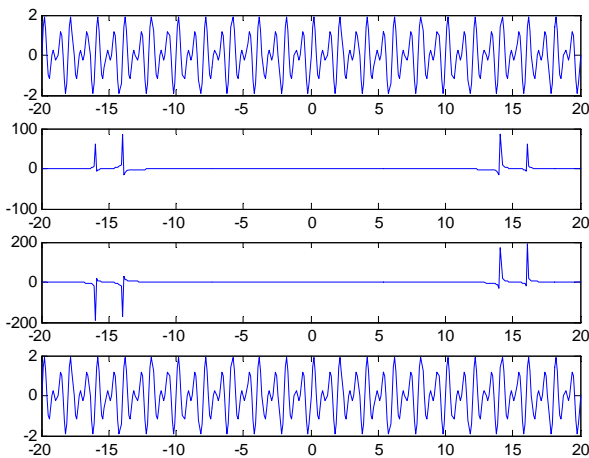


Part b

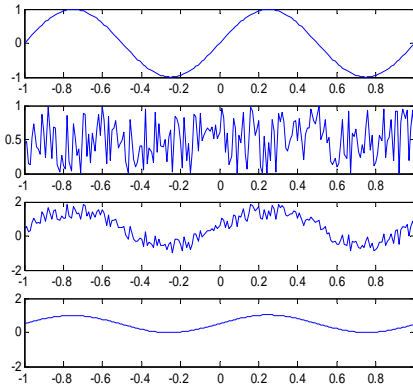
Figure 1 - Results from part 'b' SNR=1



Used Gaussian noise (randn)



Part c



Used uniform noise (rand)

Part c

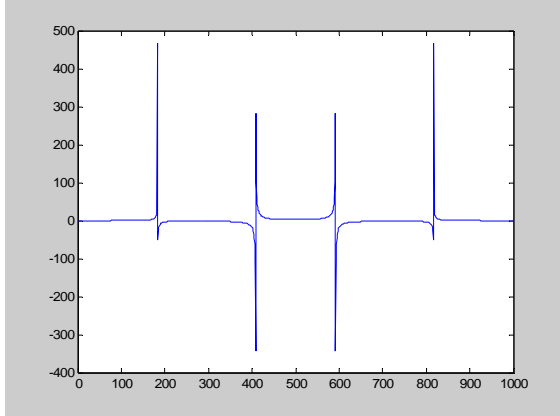
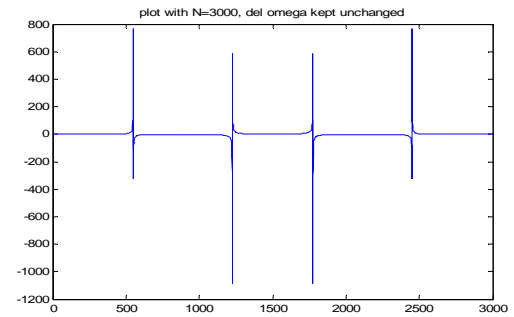


Figure 5. discrete-time Fourier Transform of a sum of two sinusoids of different frequencies



Hints for Project 2:

1) Follow the steps below to see how to derive the algorithm based on the FDTD method for wave propagation:

$$\frac{\partial^2 E_z}{\partial t^2} = c^2 \frac{\partial^2 E_z}{\partial x^2}$$

$$\frac{\partial F^n(i)}{\partial x} \cong \frac{F^n(i + 1/2) - F^n(i - 1/2)}{\delta}$$

$$\frac{\partial F^n(i)}{\partial t} \cong \frac{F^{n+1/2}(i) - F^{n-1/2}(i)}{\delta t}$$

$$\frac{F^{n+1}(i) + F^{n-1}(i) - 2F^n(i)}{(\delta t)^2} = c^2 \frac{F^n(i+1) + F^n(i-1) - 2F^n(i)}{\delta^2}$$

$$\rightarrow F^{n+1}(i) = 2F^n(i) - F^{n-1}(i) + \left(\frac{c\delta t}{\delta}\right)^2 [F^n(i+1) + F^n(i-1) - 2F^n(i)]$$

2) While implementing the code in Fortran, you should always start with variable declaration and parameter definitions, then for this Project define a Gaussian pulse initialization, followed by the algorithm for propagation.

3) In one dimension, FDTD algorithm stability requires $\Delta t \leq \frac{\Delta x}{c}$

4) Explain in your report: where should the center of the Gaussian be placed to initialize the propagation algorithm, where it should not be placed. How many points in time should the Gaussian initialization be done for? If more than one points in time what would the center of subsequent Gaussians for the algorithm to work?

5) Explain in your report: how many points to use for the spatial domain; and how many points for the time evolution?