University of Louisville **Instructor Aly A. Farag**
ECE Department **Summer 2001**

ECE521 Experiment # 2: Sampling, Quantization and Signal Reconstruction
(Issued Thursday 6/7, Due Tuesday 6/19)

The purpose of this experiment is the following:

1. Study the process of digitization of a continuous-time signal into a discrete-time sequence;
2. Study reconstruction of functions from its sampled version; and
3. Compare the sequence Fourier transform of a sequence and correspond it with the continuous-time Fourier transform, and examine the effect of changing the sampling rate.

1 Digitization of a Continuous-Time Signal

(a) Generate 2000 samples from the function $x(t) = 4\ exp(-0.2t)\ sin(4\pi t)$. Select a suitable measure for the bandwidth and use the sampling theorem.

(b) Quantize the sequence x[n] in (a) into 16-quantization level between -4.0 and 4.0 using *both* midriser and midtread quantizers. Plot x[n] and its quantized versions on the same graph.

(c) Using the sequence x[n] from part (a) above, reconstruct an approximation $\hat{x}(t)$ using realizable first-order interpolator and extrapolator. Plot x(t) and $\hat{x}(t)$ on the same graph for the two cases.

2 The Sequence Fourier Transform

(i)Compute the sequence Fourier transform of the sequence z[n] in the file z (download it from the course web page). Plot two periods of $Z(f_d)$; magnitude and phase with proper scaling.

(ii) Knowing that z[n] was obtained from z(t) by sampling at a rate of 25Hz, rescale $Z(f_d)$ in (i) and plot one period. What are the major frequency component in your plot ?

(iii) Repeat (i)-(ii) for $z_1[n] = z[4n]$,$z_2[n] = z[8n]$,and $z_3[n] = z[16n]$.

Note: *Write a neat report. All figures should have meaningful captions, properly labeled, and referred to in the text. Refrain from using any handwritten symbols, equations, etc. in your report, use a word-processor*