LIST OF PROJECTS FOR EXTRA-CREDIT

Subspace frequency/direction estimation algorithms: you will implement various signal and noise subspace algorithms such as, minimum variance, eigenvector, Pisarenko, min-norm, MUSIC, Bartlett, autoregressive, principal components, and a few other algorithms for multiple sinusoidal signals. Study the advantages of one method over the other.

Comparison of active noise cancelation algorithms: such as the LMS, RLS, CGA, hybrid LMS/RLS/CGA filters. Specifically you will look at concepts such as convergence of the tap-weights in the mean and the mean-squared sense. You will also get a sense of optimal filtering that will be covered in the class.

Spatial diversity combining techniques: you will simulate a multi-antenna receiver system with a flat Rayleigh/Rician fading channel with AWGN applied to binary antipodal signaling. You will compare the estimate average symbol error probability with theoretical expressions to demonstrate the improvement in performance when multiple antennas are used.

Implementation of a DMT system: DMT (digital multitone) systems or AT/T touch-tone standard implementation. This involves generating a DMT signal for a specified telephone number, modeling channel impairment such as silent periods or addition of noise, and finally decoding the DMT signal using different methods so that a probability of detection error can be computed.

Extensions of the CDF Quantization Approach: combining noise-shaping with oversampling with the CDF quantization scheme to improve the viability of the approach to tail-heavy distributions.

Karhunen-Loeve Transform: definition of the transform and properties and application of the transform to Gauss-Markov processes (DCT) and self-similar processes (DWT).

Sigma-Delta Noise Shaping: oversampling and decimation, feedback based noise shaping.