Simulation of Channelizer Structures
Directed by Cyclostationary Detector

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One common problem in Software-Defined Radio (SDR) systems is the problem of detecting and then isolating narrow signals of interest in wideband sampled data. This involves using some means to detect the frequency of one or more signals of interest and then tuning, filtering, and decimating them. This problem is particularly challenging due to the high sample rate of this wideband data, so efficient algorithms are very desirable. Solutions to this problem have applications in many areas, including both Cognitive Radio and Electronic Warfare.

A MATLAB simulation of an SDR framework for detecting and sub-band tuning channelized signals is presented, with a focus on finding an efficient means to combine the two algorithms. Detection is performed using the spectral-correlation density function which exploits the cyclostationary property of digital signals (William A. Gardner, *IEEE Signal Processing Magazine*, April 1991, pp. 14-36). These detections are then used to direct a channelizer which will tune, filter, and decimate all of the detected signals. Two different channelizer structures are examined – a polyphase analysis/synthesis channelizer (F. Harris, C. Dick, and M. Rice, *IEEE Transactions on Microwave Theory and Techniques*, April 2003, pp. 1395-1412) and an overlap-save filter bank (Mark Borgerding, *IEEE Signal Processing Magazine*, March 2006, pp. 158-161).

A summary of relevant background information is provided. This includes a discussion of cyclostationarity and the spectral-correlation density function as well as background on both channelizer structures. For the overlap-save filter bank it will be shown that in many cases computation can be saved by using the same FFT computation for both the cyclostationary detector and the channelizer.

In this simulation, simple QPSK signals are used to model the signals of interest, but the framework is applicable to any modulation or signal type that has cyclostationary features. While other means of signal detection may be more reliable for specific signals, a cyclostationary detector's primary strength is its ability to function for many different types of digital signals.