Abstract

The real world signal are analogue in nature but the computation is done digital. The process that makes it possible is known as the sampling process. Without the sampling process we cannot store, use, reuse or modify the real world signals. Nyquist sampling theorem tells us about how the continuous signals can be converted to digital signals, It provides a good approximation of the original signal. This approach restricts the class of signals that can be sampled and perfectly reconstructed to bandlimited signals. During the past few years, a new framework has emerged that overcomes these limitations and extends sampling theory to a broader class of signals named signals with Finite Rate of Innovation (FRI).

In this work I have used Finite Rate of Innovation to reconstruct an undersampled ultrasound signal.The FRI technique allow us to sample signals that are non-bandlimited and cannot be generally sampled using classing sampling theory that is, Nyquist sampling rate. That is, if we want to sample and reconstruct a signal back perfectly it has to be sampled at 7-10 times faster. The sampling rate directly affects the cost of the system, duration of sampling the signal and error produce from sampling the signal at high rates

The advantage that FRI gives us that it uses few sample points compared to the Nyquist theorem and by doing this we reduce the complexity of the acquisition device. Low sampling rate means less number of samples so less data space is used. To have a high sampling rate you need costly devices so looking at a technique which can lower the cost of instrument is also needed. In using FRI it gives all the above advantages. The process of sampling has allowed us to manipulate, store and transmit vast amount of data with increasing convenience. However, in data-intensive and/or power-limited applications such as sensor networks, the information contained is normally far less than the data observed, therefore, efficient sampling techniques is vital and necessary in such applications

In this thesis we consider the sampling of FRI signals and extend the results in to Ultrasound signal which is sampled at sub-Nyquist rate. We then try to reconstruct the original signal from those samples.