

## Reconstruction of the Sparse Signal by Using Approximate Message Passing Algorithm

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### ABSTRACT

Reconstruction of the Sparse signal such as for audio signal, video signal, image signal is the major important role. We are going to recover the signal for the audio signal. The signal is recovered by using two algorithm such as AMP-M and AMP-T. These two algorithm coding are written in matlab and simulation from simulink will be used to get the specific outputs. AMP-M used as multiply accumulate unit for the recovery of unstructured matrices. AMP-T used as the fast linear transform. Hence recovery of the Sparse signal with the two algorithm is the main aim of the project. According to the research we have two technique to reconstruct the audio signal like compressive sensing, building of the FPGA hardware but in our project new technique is introduced to recover the audio signal by using two algorithms such as AMP-M and AMP-T.

**Keywords:** AMP-M, AMP-T, MATLAB, SIMULINK

### I. INTRODUCTION

Sparse signal are the signal which is lost due to noise complexity of signal, low density these are all the symptoms for the sparse signal. In the project we are going to reconstruct the signal for an audio signal in the form of speech or noise. As noise signal are more prone to get affect by the external signal on the line. The technique to recover the signal back from the sparseness is very important. The signal need to in the pure form for the operation. Some times due to complexity the signal have distortion or signal become noisy. In the project we are going to use Matlab software to build our audio signal. To reconstruct the sparse signal we can use comprising method as well as by building the FPGA also we can do. There are various methods to it to use for reconstruction of signal. In this we are using two algorithms such as AMP-M and AMP-T, these two algorithms are used for the reconstruction after that these algorithms coding is done in Matlab and simulation done by simulink software. The audio signal have many variation. The compressing method used FPGA tool for the build of the audio signal as it was mentioned by many authors. The AMP (Approximate Message Passing) is the mode of authorization, creation and deletion of a user cannot be performed. important tool for the recovery of sparse signal. Amp is widely used algorithm as it has low speed application, power consumption. With respect to the AMP algorithm we are using two algorithm such as AMP-M as multiply accumulate unit for the recovery of unstructured matrices and AMP-T as the fast linear transform. AMP consist of certain functions such as threshold, RMSE, Lo units

to work with efficient manner. The input is given as the audio signal, this undergoes to various units to give us the pure form of recovered sparse signal. The FCT/IFCT transforms are used to build up the fast transoms and gives us the audio signal in the pure form with fast execution. The FCT/IFCT converts the matrix to  $M^2$  form matrix. Along with that we have RMSE (Root Mean Square error) and threshold and lo unit. These together will give us the good result for our audio signals.

### II. ALGORITHM DESIGING TECHNIQUES

AMP is a recently developed sparse signal recovery algorithm that delivers excellent recovery performance, exhibits fast convergence at low computational complexity per iteration, while requiring low arithmetic precision. AMP leads us to give two algorithm which are used for the recovery of sparse signal. They can be mentioned as :

- A. *AMP-M*: This algorithm employs parallel multiply accumulate unit for the recovery of unstructured matrices. It has sub units like RMSE, lo unit, threshold unit to work combinely to give the required output.
- B. *AMP-T*: This algorithm is used as the Fast Fourier transform. In this the signal which is in the form of DCT gets convert to FFT based FCT/IFCT. This signal works at the faster rate to give us the output.
- C. *MATLAB*: This Software helps us to write the algorithms in Matlab and the simulation done in simulink to get the required pure form of audio signal.

### III. OVERVIEW OF THE AMP-M, AMP-T ALGORITHMS

AMP-M algorithm: It consist of the input signal as audio signal , this audio signal undergoes through D-matrices .D matrices including many unstructured matrices or matrices obtained through dictionary learning e.g. Many signal restoration or de-noising problem. The input signal and the residual Input signal and residual stored in memory, coefficient each have same addresses. This leads to small S- RAM macro cells stored in separate memory.MAC unit multiply D matrices .Parallel MAC unit during compile time determines maximum achievable Output. Pipeline registers added to multiplier unit to increase maximum achievable clock frequency. RMSE used to specify sums of squares. Subsequent square root implemented which does not require multiplier & lookup tables. Threshold- it instantiates the subtract compare select unit in serial or element wise manner. lo unit – counts non zero entries of estimate signal in serial manner & concurrently to matrix-vector multiplications .Hence AMP-M employs parallel multiply accumulate units & is suitable for recovery of unstructured matrices.

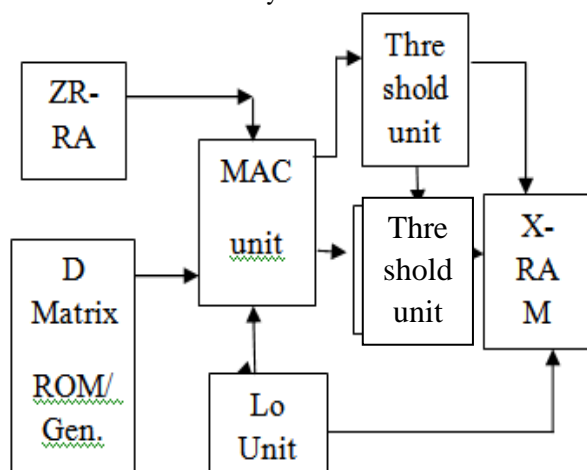


Fig.1. Block diagram of AMP-M algorithm.

AMP-T algorithm : As that of the storage memory was required for the AMP-M algorithm ,but in the AMP-T algorithm such stored memory is not required. Parallel MAC unit replaced by FFT based FCT/IFCT. Residual which was calculated in MAC unit here R-CALC unit consist of small multiplier and few adders. RMSE (Root mean square Error) calculates the result for FFT. Lo unit used to calculate FIT result. AMP-T helps reduce area, power dissipation.

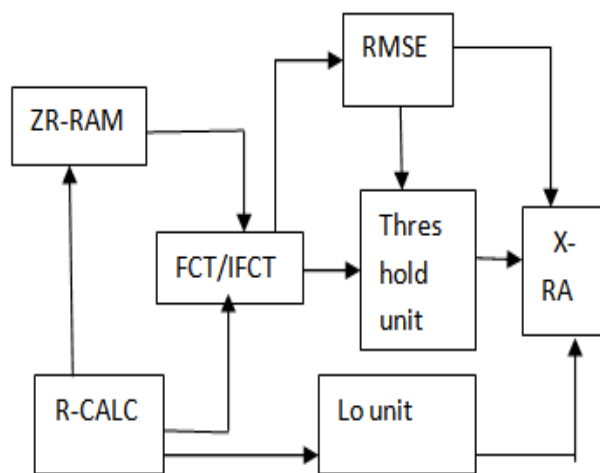


Fig.2 Block diagram of AMP-T algorithm.

### IV. DESCRIPTION FOR THE FCT/IFCT

The DCT and inverse DCT (IDCT) are widely used as computational tools in many DSP applications, such as linear filtering, frequency analysis, manipulation of data images and video streams compression. The importance of the DCT and IDCT in such practical applications is due to the existence of computationally efficient algorithms.

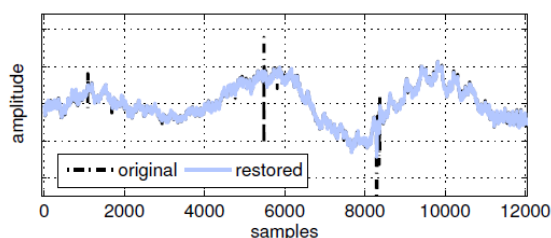
In this introductory section, the most important concepts and techniques of DSP such as: convolution, correlation, filtering, and using Fast Fourier Transform (FFT), Discrete Hartley Transform (DHT) and DCT to compute them will be presented. The audio signal undergoes in the form of FCT/IFCT. The above Block digram of Fig 2. Represent the working principal for FCT/IFCT. The D matrix has combines and gives multiple matrix. They work fast due to the FCT/IFCT transforms.The Inverse IFCT gives us the explicit matrix multiplication. The FCT and IFCT work for  $M/2$  point FFT. The real valued inverse FFT Transform Computes to get complex valued  $M/2$  point FFT. It enables us to take advantage of regular structure and low complexity of state of FFT architectures. RMSE updates the residual  $r$  to perform thresholding operation to calculate parameter  $b(lo)$ .

### V. SOFTWARE USED

**A. Matlab :** The coding for the AMP-M and AMP-T is done in matlab and simulation done by simulink. In hardware by Using FPGA we can also build the reconstruction of an audio signal but in our project we are specifically using Matlab software to get the reconstruction of audio signal.

**B. Simulink :** Simulink used to do the simulation in order to get the reconstruct audio signal.

## VI. RESULTS



The above is the tentative result for reconstruction of audio signal, yet the improvement is in the progress. From this we have improved the audio signal by removing the unwanted noise and distortion.

## VII. CONCLUSION

In this paper we have reconstructed the sparse signal for audio signal. The audio signal in the form of speech and voice is reconstructed by using two algorithms such as AMP-M and AMP-T. The coding is written in Matlab and simulation done in simulink.

There are many applications such as image signal, video signal but we have reconstructed only the audio signal for our project.

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