# CHAPTER 8

## RESULTS AND DISCUSSION

### Original Signal

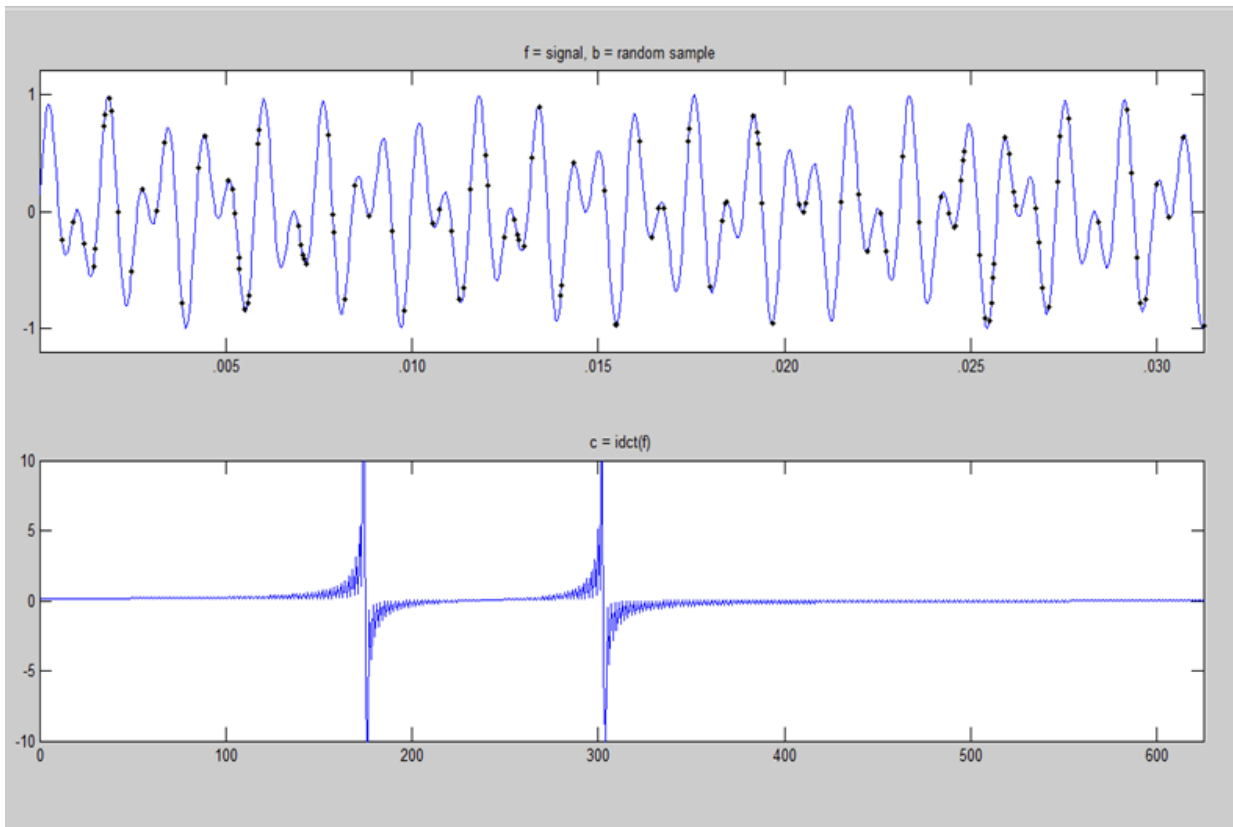

f = signal, b = random sample

c = idct(f)

Figure 8.1

Top: Random samples of the original signal generated

Bottom: The inverse discrete cosine transform of the signal

Our example uses the discrete cosine transform (DCT) as the basis. The signal generated by the user is the sum of two sinusoids with incommensurate frequencies, are given thousands of weig -hted averages of millions of signal. Our job is to re-generate the original signal. Figure 8.1 shows the following details:

1. The graph at the top represents input analog signal with the black dots representing the samples that are taken into consideration.
2. The bottom graph represents the inverse direct cosine transform (IDCT) of the input signal which are represented as two sinusoids.
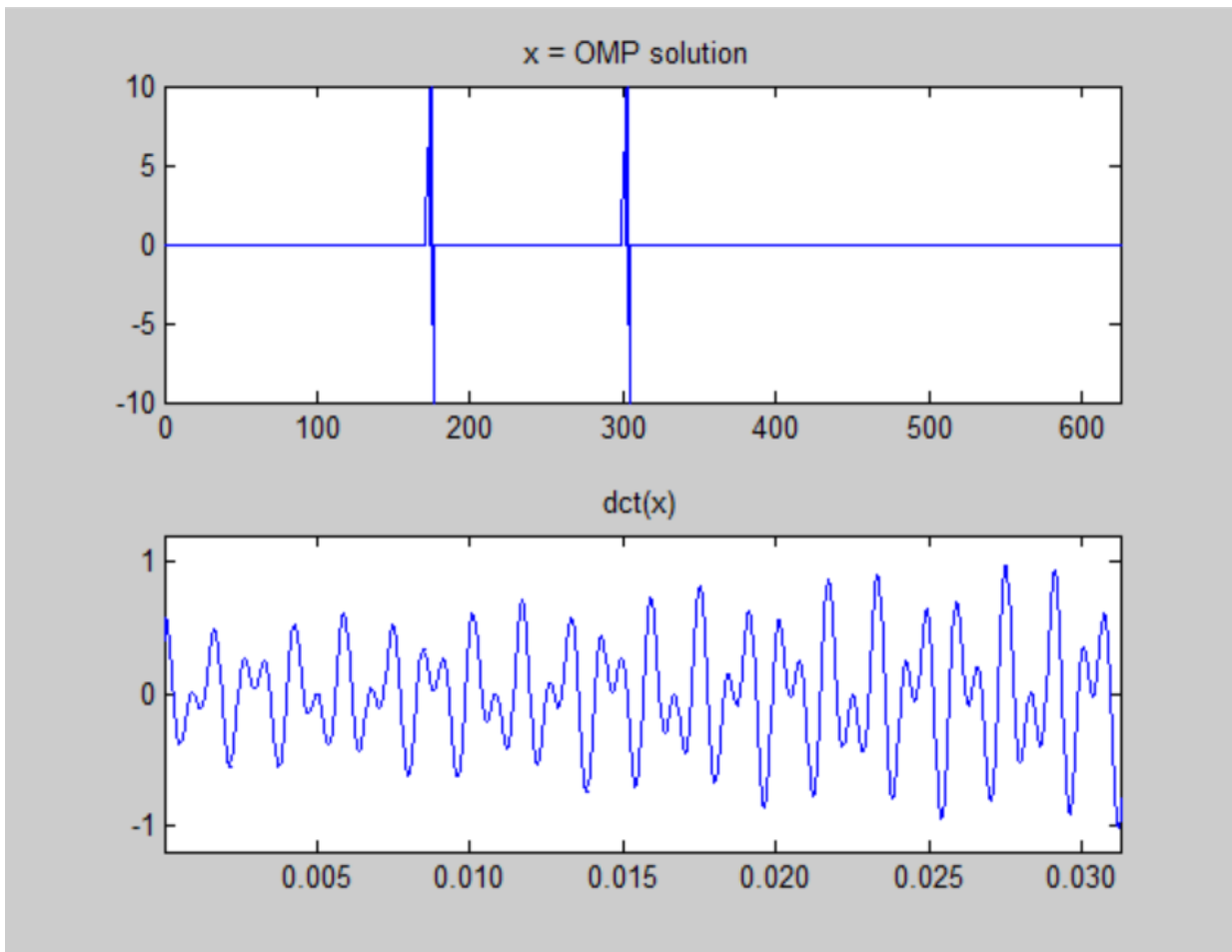
## Orthogonal Matching Pursuit Solution



Figure 8.2

Top: OMP solution of the original signal

Bottom: Reconstructed signal using OMP

Figure 8.2 shows the following details:

1. The graph at the top shows the OMP solution of the original signal.

2. The graph at the bottom is the reconstructed signal using the Orthogonal Matching Pursuit.
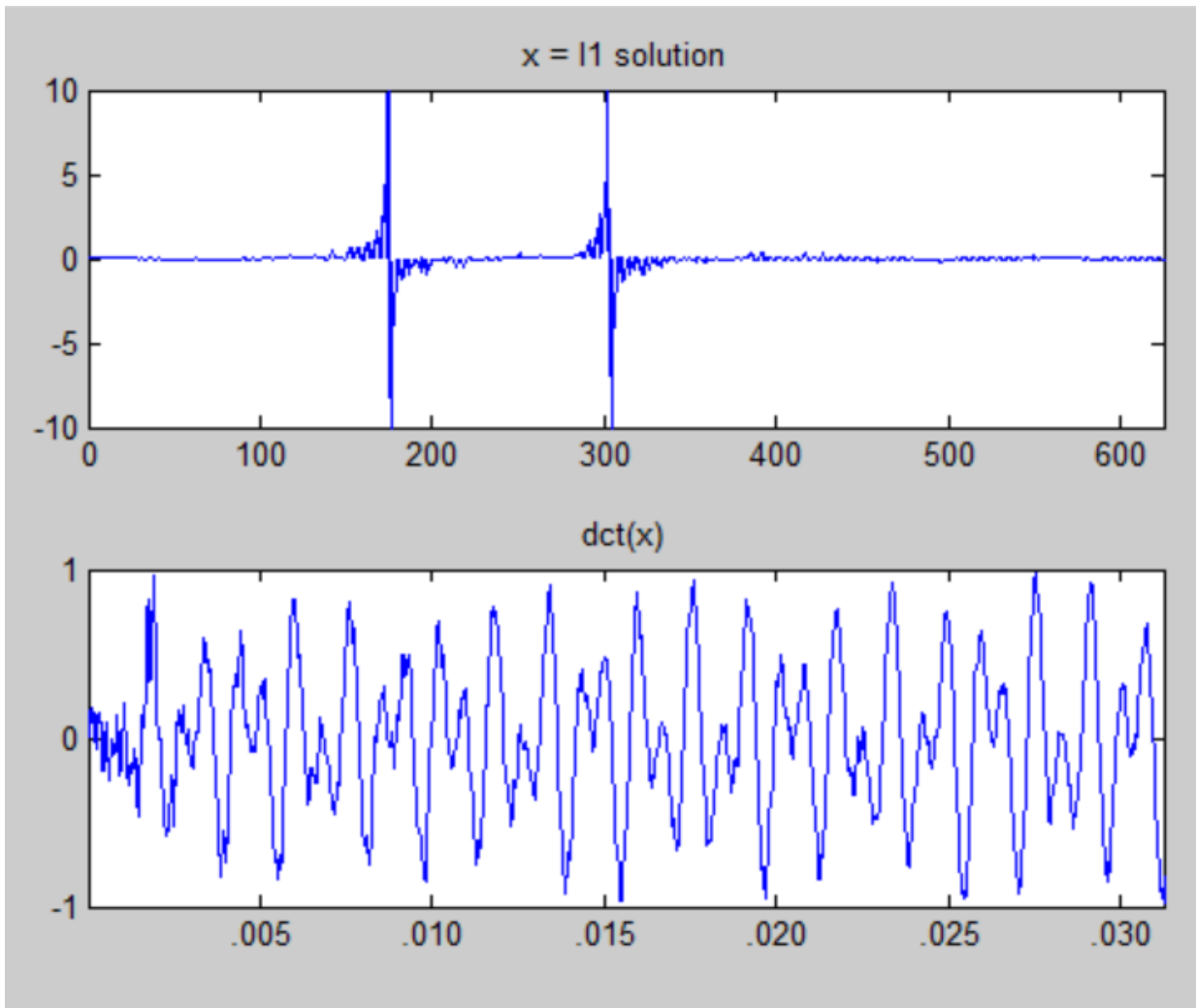
## **Basis Pursuit Solution**



Figure 8.3

Top: L1 solution of the original signal

Bottom: Reconstructed signal using Basis Pursuit

Figure 8.3 shows the following details:

1. The graph at the top shows the L1 solution of the original signal.

2. The graph at the bottom is the reconstructed signal using the Basis Pursuit sche
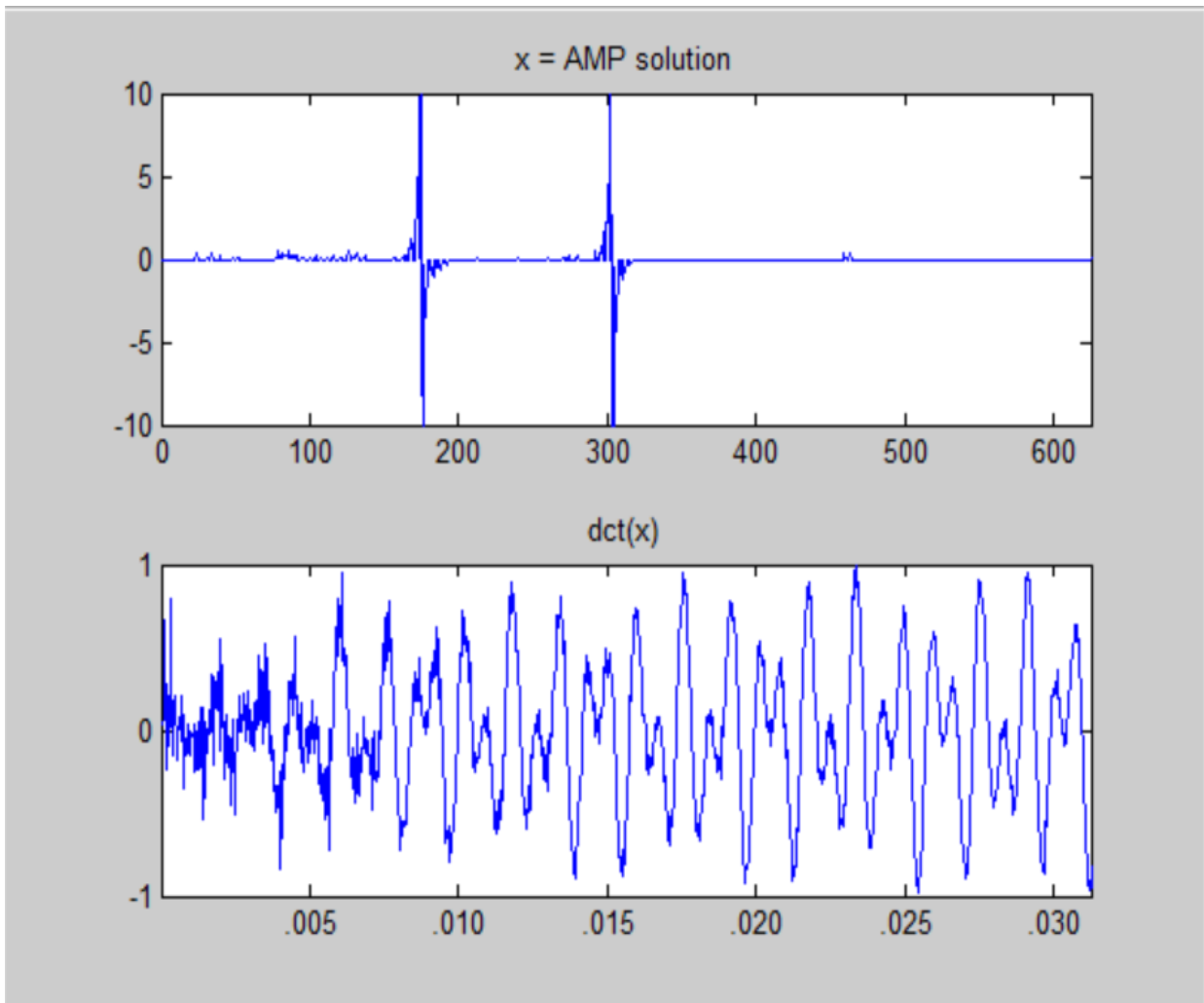   -me.

## Approximate Message Passing Solution



Figure 8.4

Top: AMP solution of the original signal

Bottom: Reconstructed signal using AMP

Figure 8.4 shows the following details:

1. The graph at the top shows the AMP solution of the original signal.
2. The graph at the bottom is the reconstructed signal using the Approximate Message Passing.

Table 8.5 shows the error rate for the three compression techniques which are calculated as:

$$\sum_{i=0}^{n} (x_i - f_i) \times (x_i - f_i)$$

where,

$x$ – solution obtained

$f$ – original signal component

| Input key | Orthogonal Matching pursuit | Basis Pursuit | Approximate Message Passing |
|-----------|-----------------------------|---------------|-----------------------------|
| 0 | 0.4638 | 0.4798 | 0.4756 |
| 1 | 0.4578 | 0.4796 | 0.4772 |
| 2 | 0.4637 | 0.4786 | 0.4725 |
| 3 | 0.4669 | 0.4563 | 0.4596 |
| 4 | 0.3805 | 0.4627 | 0.4784 |
| 5 | 0.4519 | 0.4693 | 0.4679 |
| 6 | 0.3685 | 0.4788 | 0.4809 |
| 7 | 0.4844 | 0.4647 | 0.4642 |
| 8 | 0.4891 | 0.4844 | 0.4791 |
| 9 | 0.4165 | 0.4815 | 0.4834 |

Table 8.5 Error Rate

It was found that OMP algorithm took the least time for reconstruction and had least error rate among the three reconstruction schemes
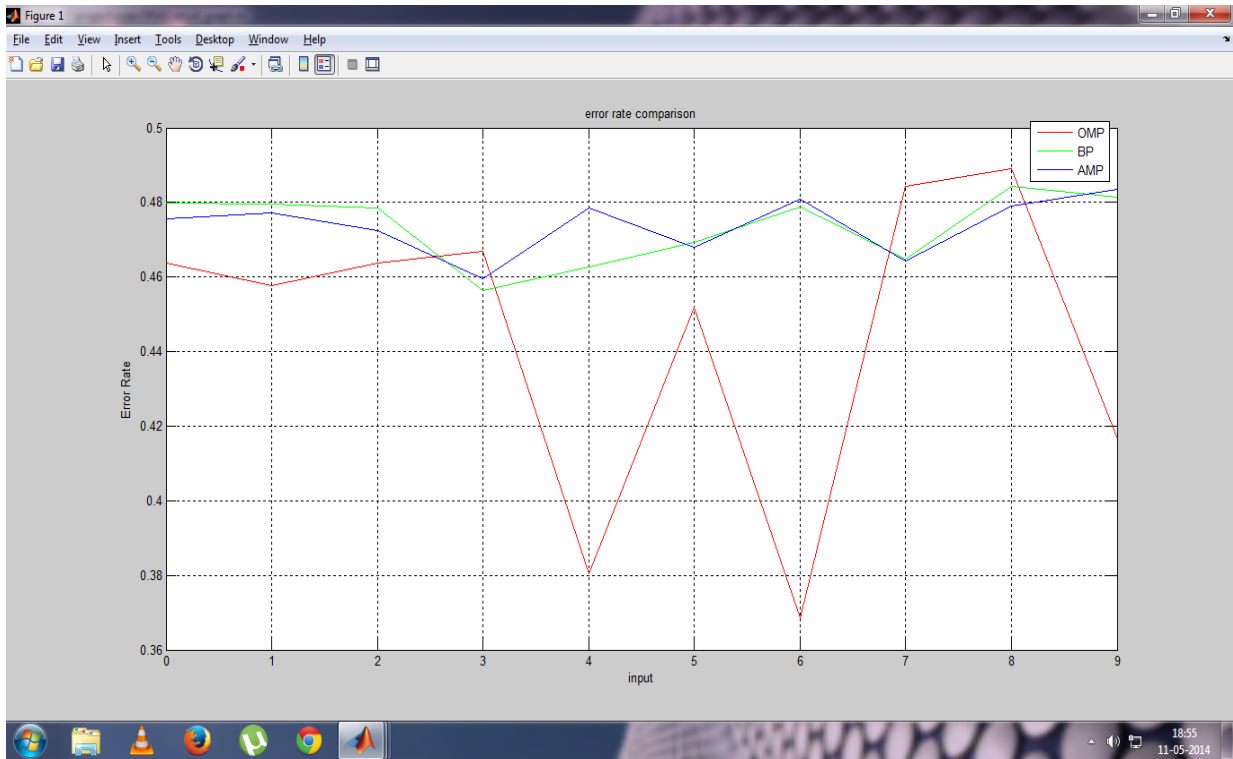
## Comparison of Error Rate



Figure 8.6 Comparison of Error rate

Average error rate for

1. Orthogonal Matching Pursuit (OMP) is 0.4443

2. Basis Pursuit (BP) is 0.4736

3. Approximate Message Passing (AMP) is 0.4739