From the three diagrams it can be found: These measurement matrixes can be approximated to recover the signal power spectrum when the compression rate is 0.5. It means that these stochastic matrixes can be successfully used in CS. It is noted that, after CS, the power spectrum comes out the apparent loss in amplitude.

Simulation analysis 2: The six kinds of matrixes have an effect on signals spectrum estimation at different compression rate. Signal parameters setting as Table 1. The expression of normalized error minimization is

$$NMSE = \frac{1}{N}\sum_{n=1}^{N}\left[\left(\hat{s}(n)-s(n)\right)^2 / s^2(n)\right] \quad (8)$$

s is the PSD vectors in Nyquist rate, $\hat{s}$ is the estimation PSD vectors in CS rate. Compression rate M/N changes from 0 to 1. The spectrum estimation *NMSE* with compression rate curves is shown in figure 5 to figure 7.

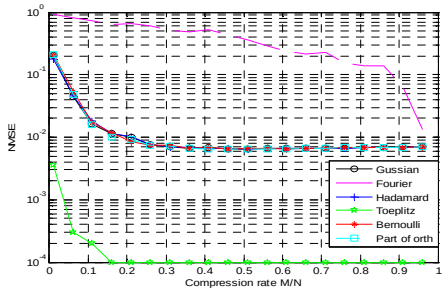

Figure.5 *M/N* and *NMSE* curve–Single-tone

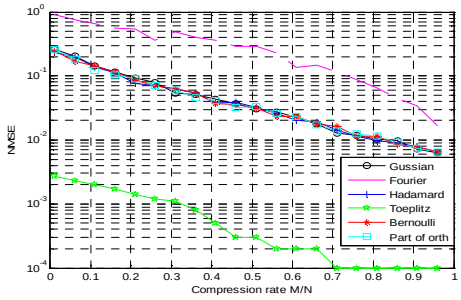

Figure.6 *M/N* and *NMSE* curve-Multi-tone

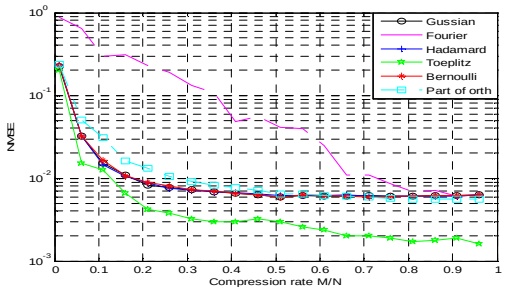

Figure.7 *M/N* and *NMSE* curve –QPSK

Thus, there are some conclusions as follows:

(1) As the compression rate increases, *NMSE* of power spectrum estimation decreases gradually; Toeplitz matrix gets the minimum *NMSE*, and Fourier matrix gets the maximum *NMSE*; and other four measurement matrixes have the similar properties.

(2) For different signals, it can be found a certain compression rate which makes these stochastic matrixes recovery the signal power spectrum in high probability;

(3) The more sparse the signal is, the better performance for recovering power spectrum at the same compression rate (by single-tone and multi-tone);

Ⅴ. The Conclusion

By summarizing the classification of the Measurement Matrix, a detailed simulation was given to compare the estimation performance of six kinds of measurement matrixes, the conclusion is made that Toeplitz matrix has the optimal performance. The conclusion is very important in selecting measurement matrix in compressive spectrum sensing. As a result of these random matrixes is random and difficult to realize in hardware circuit, deterministic matrix is studied and whether existing an optimal deterministic matrix for a stable PSD algorithm is the next step to solve.

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