# A Simple Automatic Modulation Classification Method using a Frequency Discriminator

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## 1 Introduction

An automatic modulation classification(AMC) has various military and civilian applications. There are several classifiers based on statistical moments[1], neural networks[2] and wavelet transforms[3], but these methods suffer from high computational costs. A simple classifier based on a frequency discriminator was proposed in [4]. We extend their method to M-ary FSK signals and evaluate the system performance.

## 2 Proposed Classifier

Our proposed classifier using a frequency discriminator is shown in Fig.1. For phase modulated signals, a phase is constant over each symbol interval and changes abruptly only at symbol boundaries. This causes the discriminator to produce a narrow pulse when a phase change occurs and a zero level otherwise. On the other hand, frequency modulated signals have a phase which is constantly changing. This results in a non-zero discriminator output, which can be easily distinguished from the output to a PSK signal. Also, the output level of a discriminator to M-ary FSK signals varies with the transmitted symbols. We can use this information to identify the levels in M-FSK modulated signals.

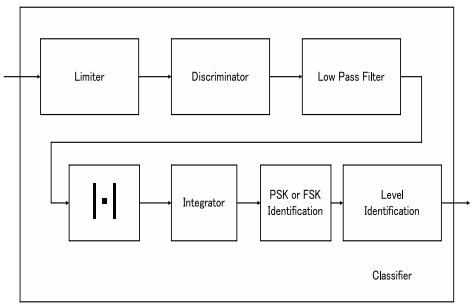


Fig. 1 Proposed Classifier

## 3 System Performance

The modulation formats considered here are 2-PSK, 2-FSK, 4-FSK and 8-FSK, but our method can easily be extended to M-ary signals. Fig.2 shows the average probability of identification error $P_e$ defined by

$$P_e = 1 - \frac{1}{N_{mod}} \sum_{m=1}^{N_{mod}} P_c(m), \qquad (1)$$

where $P_c(m)$ is the probability of correct classification for the $m$-th modulation format and $N_{mod}$ is the number of potential choices of modulation formats.

When the number of symbols using in identification is 20, the average probability of identification error is less than $10^{-5}$ at values of SNR above 30dB. This shows that the performance of our method is good even in the presence of noise.

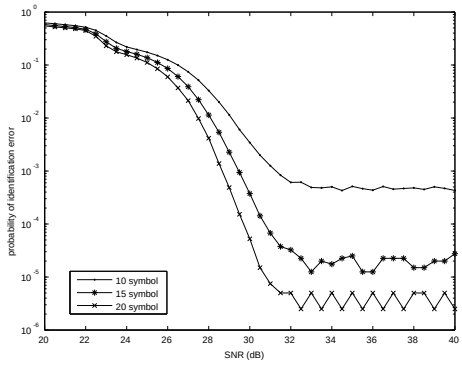


Fig. 2 Average Probability of Identification Error $P_e$

## 4 Conclusions

We proposed a simple method to automatically identify PSK and M-ary FSK modulation schemes using frequency discriminator. Results from a digital implementation show that the performance of our method is good even in the presence of noise.

## References

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