

Specific Emitter Identification of Burst Signals Based on Transient Fingerprint Feature

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Introduction

Specific emitter identification (SEI) is the technology only using the external features of the received signals to identify the emitters. The SEI methods based on transient features usually have three steps, which are detection of transient process, feature extraction and features classification. Capturing the transient process of burst signals with channel noise accurately is one of the key issues for SEI algorithms based on transient process, which directly affects the recognition accuracy. Modeling and analyzing the non-ideality features during the process of turning on-off the transmitter, and extracting the different features, is the core issue of SEI algorithms.

Research Questions

The following two questions are focused on:

- 1) The detection of the transient process of the burst signals;
- The fingerprint feature estimation of the emitters from one manufacture with the same model.

Methodologies

The paper provides a transient process detection algorithm based on maximum likelihood estimation, and the transient distortion model for burst signals is established. The instantaneous amplitude distortion feature extraction algorithm and support vector machine based feature classification method are presented.

Tables

Table 1. The identification of the test samples of four radio devices

Result ID	Ratio1	Ratio 2	Ratio 3	Ratio 4	Recognition accuracy
Ratio 1	197	0	0	3	0.985
Ratio 2	4	196	0	0	0.98
Ratio 3	0	0	200	0	1
Ratio 4	3	0	0	197	0.985

Mathematical Formulas



 $\hat{\theta} = (\Phi^T \Phi)^{-1} \Phi^T R$



Figure 1. Relationship between estimation accuracy and deviation of transient

Conclusion

The turn on-off feature of the transmitter is an important component of fingerprint features and plays a very important role in SEI. This paper studies the detection algorithm for transient processes of sudden signals, and uses actual data to analyze the impact of transient process detection accuracy on recognition accuracy; By establishing a transient process distortion model, a transient distortion feature extraction algorithm is derived, and transient process instantaneous amplitude distortion features are extracted. The effectiveness of the algorithm is verified through experiments on four actual collected UHF radio, with an average recognition accuracy of 98.75%. This algorithm is suitable for individual identification of burst signal, and has high recognition accuracy.

This paper develops the transmitter as a linear constant coefficient mathematical model. The next research work will focus on building of the nonlinearity mathematical model and proposing the corresponding method to estimate the character parameters.