

应用

卫星通信中数字调相信号调制方式识别方法研究

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摘要:

通信信号的调制样式识别在非协作通信中具有重要的研究意义。针对卫星通信中调制方式不断向高阶发展的情况,提出了一种针对常用数字调相信号调制方式自动识别的算法。本文首先给出了卫星通信中数字调相信号的函数模型,介绍了不同调制样式的特点,给出了不同调相信号的星座图。在调制样式识别的研究中,六阶及更高阶的累积量很少用到,本文利用调制信号的八阶累积量和四阶累积量特征的关系,提取出信号的特征呢高参数,对QPSK、8PSK和{16APSK、32APSK}信号进行了区分,证明四阶以上累积量也可以为信号特征提供有用信息。然后通过高阶APSK信号进行统计分析,采用一种快速收敛且有效的遗传算法,进行实数编码、交叉等操作,计算出采样信号平方幅度比,提取出APSK信号的统计特征参数,从而对{16APSK、32APSK}信号进行区分。这种算法对信号的相位偏差具有不变性,同时可抑制加性高斯噪声,特征参数具有很强的鲁棒性;与其它识别算法比较,它具有稳健、应用广泛、实时性强的特性。通过计算机仿真表明,在给定的数据长度和中等信噪比条件下,可得到很高的识别率(>96%)。

关键词: 调制方式自动识别; 遗传算法; 高阶累积量; 均方幅度比

Automatic recognition for the digital phase modulated signals in satellite communication

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Abstract:

Communication signals' modulation recognition has great signality in non-cooperative communication. To investigate the automatic modulation recognition of high-order digital phase modulated signals widely used in satellite communication currently, such as QPSK, 8PSK, 16 APSK and 32 APSK, an algorithm for modulation recognition based on higher-order cumulants of signal and genetic algorithm is proposed. The paper recommends the different modulations in satellite communication, and gives the constellations of different modulations and the high order cumulants of different signals. It is shown that the higher-order cumulants which are higher than four-order can provide some useful information of signals through the recognition of QPSK, 8PSK and {16APSK, 32 APSK}, which is based on higher-order cumulants. First, the modulation of QPSK, 8PSK and {16APSK, 32APSK} will be recognized based on four and eight-order cumulants of signals. Second, the left signals will be treated with genetic algorithm, which is a fast-convergent and better stable genetic algorithm. It is the real number code and arithmetic crossover that are used in the genetic algorithm. The arithmetic crossover can effect the diversity in gene level in real number code under a certain condition, the ratio of signals' amplitudes will be gained finally. Then the modulation of 16APSK and 32APSK could be recognized based on the arithmetical ratio of signals' amplitudes with constellation characters, which is proved to be effective according to some simulation results. It is invariant with respect to difference of amplitude and phase, it is robust and widely usable. The efficiency of the algorithm is proved in theory, and the feature of the signal is more stable than other algorithms. Computer simulations show that the proposed recognition algorithm is effective in performance, and the application of this algorithm in low signal-to-noise ratio with a specified sample size results in high probability of correct identification(>96%).

Keywords: higher-order cumulant

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