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基于提前停止判决的编码软信息辅助载波同步

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Code-aided Carrier Synchronization via Soft Decision Feedback Based on Early Stopping Criterion

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摘要 针对目前编码辅助载波同步算法中复杂度较高、延时大的问题,提出了引入辅助停止判决机制的编码辅助载波同步算法。在现有的编码辅助载波同步结构基础上,该算法能对环路信噪比(SNR)进行实时判定,在环路SNR满足限定条件后提前停止编码辅助载波同步迭代,而不影响译码性能。采用新的相位估计方式估计含相位噪声的载波相位,提升了该条件下的环路信噪比。仿真采用码率为1/2的低密度奇偶校验(LDPC)码作为编码方式,结果表明:在误码率为10^{-5}时,该算法减少了约50%的编码辅助载波同步迭代次数;在含相位噪声的信号条件下,与理想解调译码相比,性能损失不超过0.15 dB。

关键词: 低信噪比 LDPC码 编码辅助 深空通信 提前停止判决 相位噪声

Abstract: In order to solve the high complexity and high latency problem in current code-aided carrier synchronization scheme, a new code-aided carrier synchronization scheme which induces an early stopping mechanism is proposed. On the basis of the existing code-aided carrier synchronization structure, the proposed scheme makes decision of the loop signal to noise ratio (SNR) on the fly. The code-aided carrier synchronization will stop after the loop SNR exceeds a predetermined criterion with no performance degradation. With the improved phase estimation method, a carrier signal phase with phase noise can be estimated while the loop SNR also increases. Using 1/2 low density parity check (LDPC) code in simulation, the results show that the number of iteration in the proposed code-aided carrier synchronization decreases by about 50% when the bit error rate is 10^{-5}; with phase noise signals, the performance degradation is less than 0.15 dB as compared with the ideal decoding performance.

Keywords: low signal to noise ratio LDPC code code-aided deep space communications early stopping decision phase noise

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