多码长码率兼容的多元 LDPC 码及编码器设计

廉晶汇，赵旦峰，朱鹏景

(哈尔滨工程大学 信息与通信工程学院，哈尔滨 150001)

摘 要： 为适应海上无线通信信道的时变特性，突破多元 LDPC 码长码率不兼容的技术现状，构造一种多码长码率兼容的多元 LDPC 码，可以实现在多种码长、多种码率间的相互兼容，并完成编码器的设计.借鉴 5G 二元 LDPC 码校验矩阵的特殊结构并将其扩展至伽罗华域，设计的多元 LDPC 码在兼容多码长码率的同时，又拥有优秀译码性能和较低的硬件实现复杂度.该设计在 Xilinx xc7k325tffg900-2 芯片上进行实现，采用部分并行的编码方式，兼顾编码效率和硬件开销，可以实现五种信息位长和五种码率间灵活切换.工作时钟频率可达 370 MHz，在该时钟频率下编码器吞吐率最高可达 601.8 Mbps.

关键词： 多码长码率兼容；多元 LDPC；编码器；5G

Multi-length and multi-rate compatible nonbinary LDPC code and encoder design

LIAN Jing-hui，ZHAO Dan-feng，ZHU Peng-jing

(Information and Communication Engineering, Harbin Engineering University, Harbin 150001, China)

Abstract： In order to adapt to the time-varying channels for maritime wireless communication systems and break through the current state on length and rate incompatibility of nonbinary LDPC. We construct a nonbinary LDPC code which compatible between multiple lengths and multiple rates, and complete the design of the encoder. Drawing on the special structure of the 5G binary LDPC check matrix and extending it to the Galois field. The designed nonbinary LDPC check matrix not only compatible between length and rate, but also has excellent decoding performance and low hardware implementation complexity. The design is implemented on the Xilinx xc7k325tffg900-2 chip. It adopts partial parallel encoding, taking into account the coding efficiency and hardware overhead. It can realize flexible switching between five information lengths and five code rates. The working frequency of the clock can reach 370MHz, and the encoder throughput can reach up to 601.8Mbps at this clock frequency.

Key words： length and rate compatible; nonbinary LDPC; encoder; 5G

作者简介：

廉晶汇 男，（1994-），硕士研究生.研究方向为信道编译码算法以及硬件实现.E-mail：s317080051@hrbeu.edu.cn

赵旦峰 男，（1961-）教授、博士生导师.研究方向为通信信号处理、无线通信技术、水声通信技术、视频信号处理以及半实物（物理）仿真技术等.

朱鹏景 男，（1995- ），硕士研究生.研究方向为信道编码.