Abstract

Memory cells have been protected from soft errors for more than a decade; due to the increase in soft error rate in logic circuits, the encoder and decoder circuitry around the memory blocks have become susceptible to soft errors as well and must also be protected. Here introducing a new approach to design fault-secure encoder and decoder circuitry for memory designs. The key novel contribution of this paper is identifying and defining a new class of
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error-correcting codes whose redundancy makes the design of fault-secure detectors (FSD) particularly simple and further quantify the importance of protecting encoder and decoder circuitry against transient errors. By using that Euclidean Geometry Low-Density Parity-Check (EG-LDPC) codes have the fault-secure detector capability. Using some of the smaller EG-LDPC codes, can tolerate bit or nanowire defect rates of 10% and fault rates of 10^-18 upsets/device/cycle, achieving a FIT rate at or below one for the entire memory system and a memory density of 10^{11} bit/cm^2 with nanowire pitch of 10 nm for memory blocks of 10 Mb or larger. Larger EG-LDPC codes can achieve even higher reliability and lower area overhead.

Reference

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Index Terms

Computer Science

Wireless

Key words

nanomemories
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