

Software Implemented Fault Tolerance through Data Error Recovery

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This paper examines how a new software-implemented data error recovery scheme can be so effective in comparison to conventional Error Correction Codes (ECC) during the execution time of an application. The proposed algorithm is three times faster than the conventional software-implemented ECC and application program designers can easily implement the proposed scheme because of its simplicity while designing their fault tolerant applications at no extra hardware cost. The proposed software-implemented scheme for execution-time data-error detection and correction relies on three-fold replication of application data set as a basis for fault tolerance.

1. Introduction

In this proposed scheme, we have used an error-masking scheme as well as a data recovery scheme that corrects the corrupted data. We have used triplicate data model. The proposed approach is suitable for any application that refers to a set of data during its computation time and that has no memory space problem for accommodating triplicate data, whose correctness is very important for producing correct output. Three images of a lookup data of an application under execution are kept in the system memory. Upon execution of the application, three bytes are fetched from the three different images stored in different memory segments and compared to check the validity of the fetched data byte. If more than two fetched bytes have the same contents, the byte is considered as fault-free, otherwise, faulty. The proposed scheme is compared to some other available error checking and correcting codes. ECC codes are commonly used for solid-state memory systems for online error detection and correction. CRC codes are for checking the validity of the data over unreliable communication links. BCH codes are another cyclic coding scheme for error detection and correction. RS codes are block-based error correction codes commonly used for massive storage media such as CD, DVD, etc. The proposed scheme aims to supplement the conventional ECC codes. Design of online low-cost software implemented scheme for data error or byte error detection and recovery thereof is always useful for any low-cost reliable application systems. Simplicity of a scheme is equally important for system engineers while employing such scheme in their application systems. Here, we focus on software implementation for an application's data-byte-errors-detection and correction only through an extended triple modular redundancy (TMR) -type scheme and error masking. This technique is applicable to any table look-up scheme. Short duration noises often cause random data corruption in the primary memory of a computing machine. Electrical Fast Transients (EFT), Electrostatic Discharge (ESD), Electromagnetic Pulses (EMP) are the example of short duration noises. A scientific application often computes erroneous results if it reads bad data from a table. Often, we take it granted that our program code and data banks are absolutely correct while designing software for an application. But, it is always not correct because the high-speed processing units are often victimized by short duration noises [1-4].

