
СОВРЕМЕННЫЕ ПРОБЛЕМЫ НАУКИ И ТЕХНИКИ

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INCREASING THE SYSTEMS RELIABILITY

This paper includes some possibilities how to solve problems with the improvement of systems reliability on the field where traditional methods of EMC are not sufficient. Two basic types of methods will be introduced. First, methods of software redundancy and second methods of time redundancy will be presented. Then Two Rail Logic will be presented for increasing reliability of system.

Introduction

The methods of EMC are concerned with the radiated and conducted emissions on systems, predominantly in hardware platform. In our article we would like to introduce some methods of elimination of the influences of emissions on transmission or computed data by using the software method. In most cases it is possible to detect errors or failures on existing systems via using these methods. These are always suitable to improve the communication between decentralized systems. The methods which can do that in software area are methods of software and time redundancy. For hardware area the Two Rail Logic can be used.

The methods of software and time redundancy possess an advantage of possibilities to use them without additional modification of hardware platform. However in some cases the increase of reliability is possible only with changing the hardware platform, or changing the whole conception of design. This is Two Rail Logic case.

Software redundancy methods

The basic idea of this method is in using insured code on communication between decentralized systems or can be used in processing with signals thus being able of easy detection of a hardware failure. From all possible codes we would like to present only the most preferred ones. Often the codes with constant of Hamming's distance (e.g. $Hd = 2$ or more) are used, which can detect possible errors on transmitted data. In case of high value Hd the correction is possible. For detection and repair the following equation can be set:

$$Hd \geq 1 + 2c + d,$$

where c – represents a number of bits to be corrected; d – represents number of errors to be detected.

For example in case of $Hd = 2$, using 3 bits, we obtain only four cases from eight possible.

0 0 0
0 1 1
1 0 1
1 1 0

However when only one error is detected, correction is impossible (Fig. 1).

In $Hd = 3$, using 3 bits, only two possibilities remain.

0 0 0

1 1 1

in this case it is possible to detect two errors and one error can be corrected.

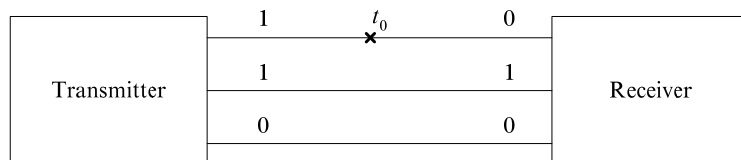


Fig. 1. Failure T_0 on transmission bus

Another method is using a code with parity in cases where there are more possibilities of parity applications:

a) Word parity.

One of the easiest ways is simply adding the parity bit at the end of the word (Fig. 2).

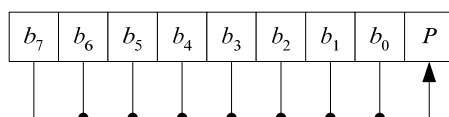


Fig. 2. Word parity

b) Cross parity.

This method provides much better word security than the one described previously (Fig. 3).

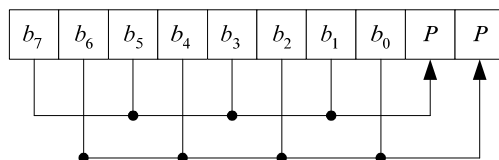


Fig. 3. Cross parity

c) Parity overlapping.

This method offers a possibility of correcting errors however the redundancy is larger (Fig. 4).

d) Other.

Last but not least among the methods of improving the reliability we would like to present one method based on check sum.

1 1 0 1

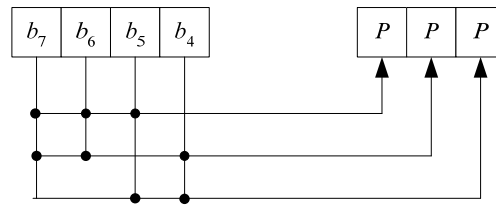


Fig. 4. Parity overlapping

Honeywell method.

This method divides bytes into two columns (Fig. 5) and the check sum will be added. The transmission is conducted with original number of data wires (similar to a method of single or double precision). Added redundancy is identical to the method of double precision.

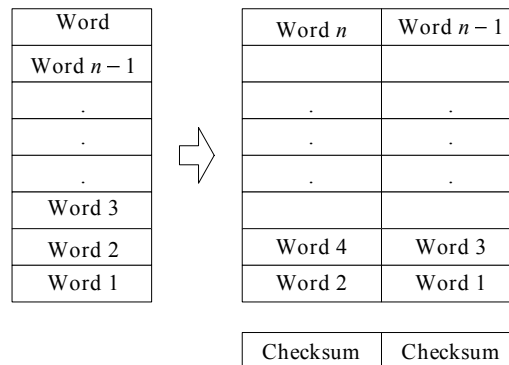


Fig. 5. Honeywell method

Original data		data after modification	
0 0 0 1		0 0 0 1	0 1 1 1
0 1 1 1		<u>0 0 0 0</u>	<u>0 1 1 0</u>
0 0 0 0	check		
0 1 1 0	sum	0 0 0 1	1 1 0 1
Transmitted data		Data after modification	
0 0 0 1	1 0 0 1	1 0 0 1	1 1 1 1
0 1 1 1	1 1 1 1	<u>1 0 0 0</u>	<u>1 1 1 0</u>
0 0 0 0	1 0 0 0	0 0 1 0	1 1 0 1
<u>0 1 1 0</u>	<u>1 1 1 0</u>		
0 0 0 1	1 0 0 1	Received check	
1 1 0 1	1 1 0 1	sum	
		1 0 0 1	1 1 0 1

Error on data bus is detected again.

Another way is using the cycle codes, the arithmetical codes etc.

Methods of time redundancy

The basic idea is to do any operation e.g. numerical or the data transfer repeatedly – then compare the results. The advantage of this method is that it is able to detect short random errors or serious permanent failures. These methods mostly do not require any hardware platform changes. Software changes will usually do. The disadvantage is the length of the computing time.

The strategy of transient errors detection

The principle is presented in Fig. 6. Every operation is done repeatedly. The interpretation of results can be various. In one case it can be used only as an error indicator, in other case it may contain the corrected result (after voting).

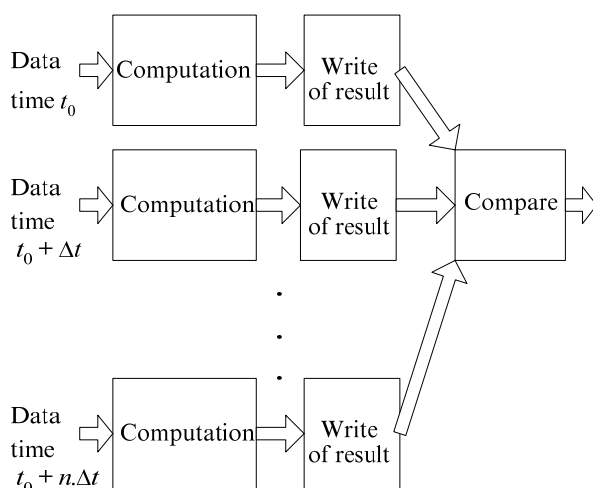


Fig. 6. Strategy of transient errors detection

The strategy of permanent failure detection

In this method the calculation is again done repeatedly (in most cases two times: second step in calculation is realized with inverted data). This is a software solution of Two Rail Logic – in hardware field (Fig. 7).

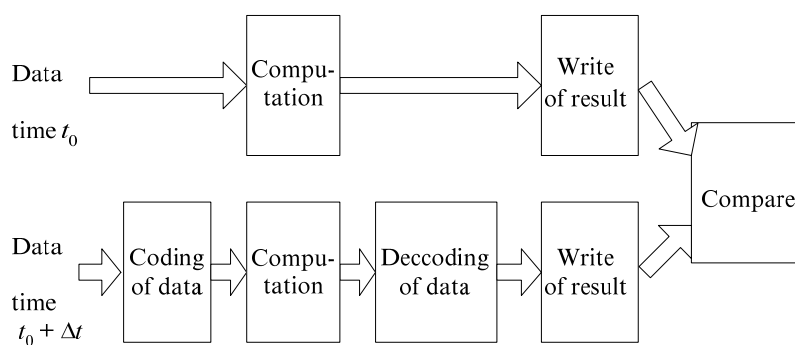


Fig. 7. Strategy of permanent failure detection

To fulfill the previous, the following equation has to be valid:

$$f(x) = \overline{f(\overline{x})}$$

in which $f_d(x)$ is the dual function of $f(x)$ function (if $f_d(x) = \overline{f(\overline{x_1}, \overline{x_2}, \dots, \overline{x_n})}$).

If $f_{vd}(x)$ is the function with own duality and if $f_{vd}(x) = x_{n+1} \cdot f(x) + \overline{x_{n+1}} \cdot f_d(x)$, then complementarily inputs generate complementarily outputs, the outputs are identical by Two Rail Logic.

Recomputing with Shifted Operands – RESO Method:

1. Step – computing with original operands (Fig. 8).

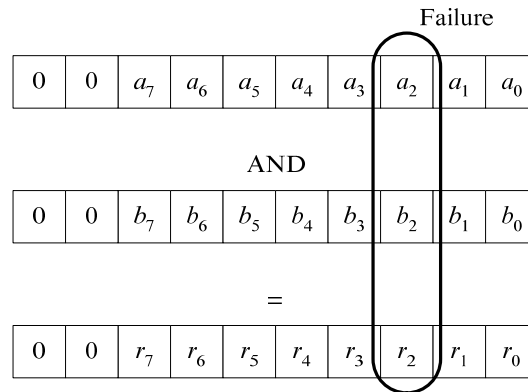


Fig. 8. Computing with original operands

2. Step – recomputing with one times shifted operands (Fig. 9).

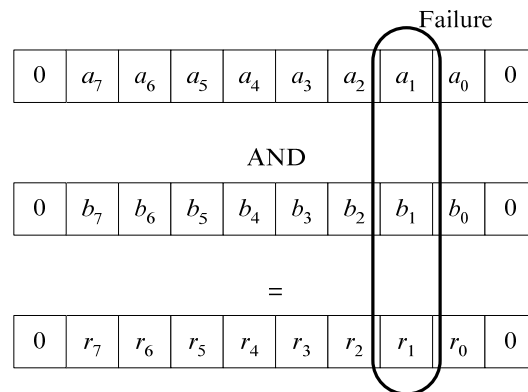


Fig. 9. Recomputing with shifted operands

3. Step – recomputing with two times shifted operands (Fig. 10).

Result after shifting.

After voting we obtain correct result (Fig. 11).

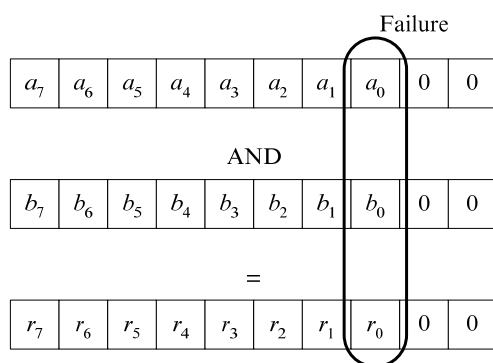


Fig. 10. Recomputing with two times shifted operands

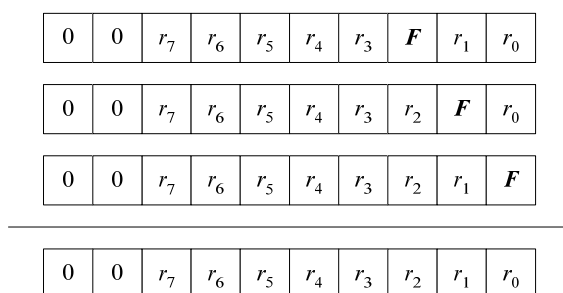


Fig. 11. Result after voiting

Two rail logic method

Basic idea for this method is to do everything by two “rails”. First rail has normal output and second has inverted output. In case of failure the outputs aren’t inverse form (Fig. 12).

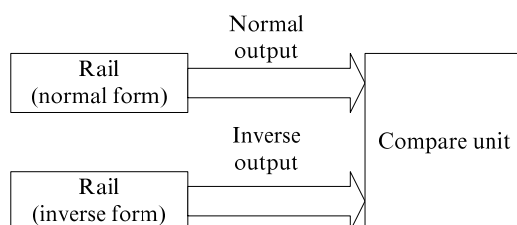


Fig. 12. Two rail logic

For Two Rail Logic the design of compare unit is very easy. It is enough to only compare inverse between outputs. For this purpose a solenoid relay is best choice. Safeguard relay has a failure asymmetry. Each failure on safeguard relay ends with disconnected relay contact. But output must be able to drive a relay. Two rail logic method is able to detect hardware failure and software errors. Disadvantage for this method is only difficult implementation into existing systems.

Conclusion

In our article we wanted to introduce interesting possibilities of improving the reliability of existing systems, or software possibilities in the field of errors or failures detection. These methods can be easily applied e.g. in insuring reliability controlling. Also they can be used when evaluating results in decentralized systems in surrounding with radiated or conducted emissions. (In such case usual resources of EMC are not sufficient for preventing the intersection of emissions into transmission channel or system itself). Two rail logic method can be used in new designed system. However best choice is combining introduced methods interactive.

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ONLINE LEARNING EXPERIENCE IN SYRIA

In this paper we speak about virtual learning and offer our experience in online learning. We started in talking about targeted students and specialties then we discussed administrative, electronic content requirements, assessment rules and measures, software and infrastructure requirements. Finally we gave our opinion about different types of learning including online learning.

Introduction

In the advent of developed network and computer systems, information technologies and communication led to what we call virtual learning or online learning where the student and teacher can interact through the net, lectures are given remotely, a lot of tools are used to make learning powerful and interesting. Mostly targeted to those who don't have chances to attend traditional universities and offers specialties which fulfill this sector of learners needs.

Online learning dislike other learning methods has some different requirements and faces a lot of challenges. It requires certain administrative structure, software packages for virtual classroom achievement, learning and assessment management software which complies with certain standards, network management system, development tools, and an appropriate network equipment infrastructure.