universidade de aveiro

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CRC-8

Cyclic Redundancy Check

Arquiteturas de Alto Desempenho

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CRC-8 OVERALL APPROACH

- In order to develop a solution to **protect the integrity of a message**, a CRC should be implemented with a polynomial of:

$$x^8 + x^7 + x^5 + x^2 + x + 1$$

  Thus, for the given CRC generator, the corresponding binary pattern is **110100111.**

- The **message** and the result of the division (**remainder**) by the above polynomial are sent **together** by the **Encoder**, when sending the message, so that when it is received, the CRC **Checker** can perform the division and **compare** it with what was first received.

- If **equal**, the message was not corrupted during the "journey/trip" to the receiver.

- To validate the precision of the implemented CRC8 components, a series of tests were devised using Quartus Prime waveforms.

ENCODER - APPROACH (PARALLEL)

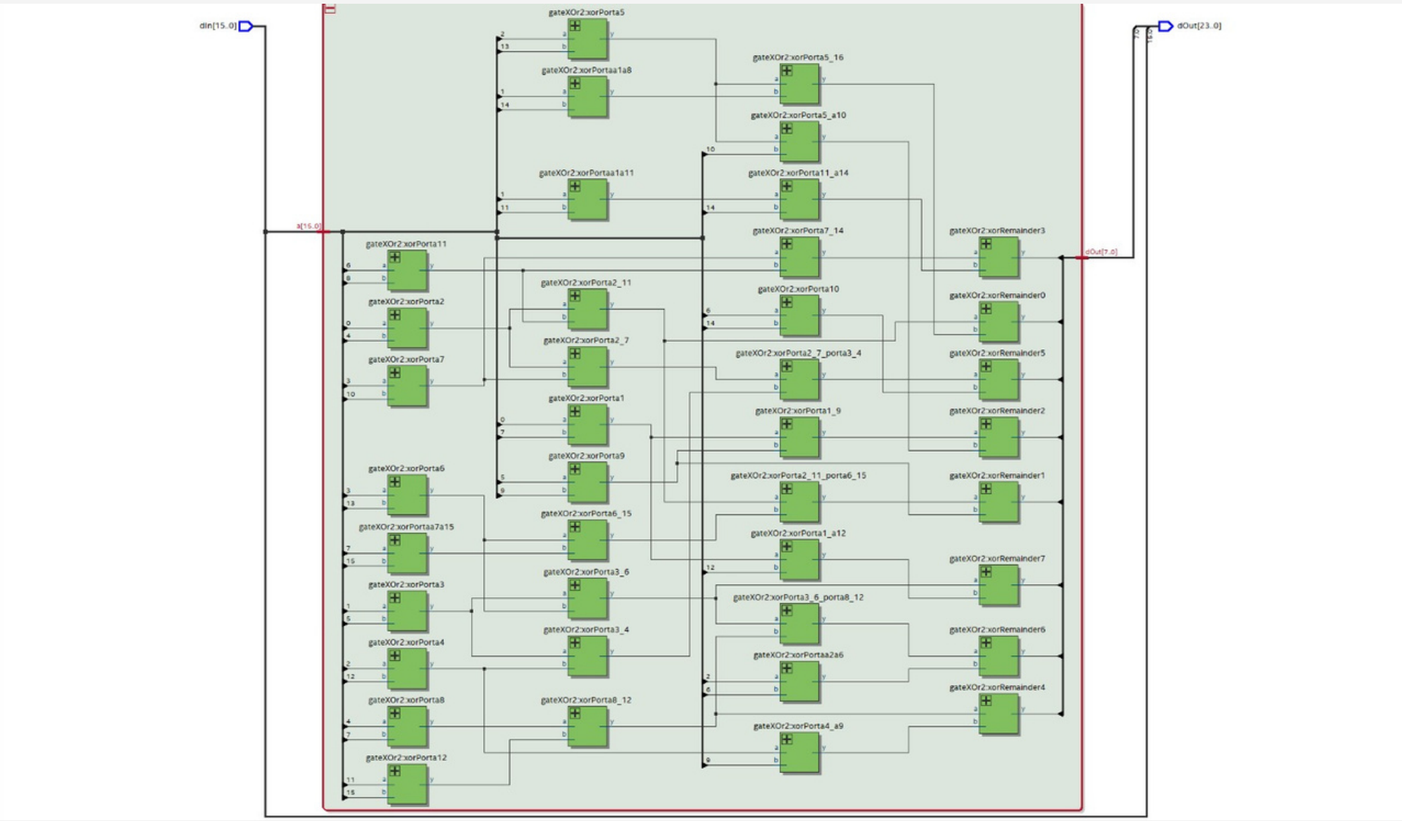
- The **CRC8 Encoder** circuit processes a 16-bit data word to generate an 8-bit CRC-8 Bluetooth check string. The key component is the **remainder calculation block,** responsible for computing the **properties of the remainder** as well as finding the **best possible algorithm.**
  - An **auxiliary table** was created to find out the common groups/**combination** of operations in order to **reduce the XOR gates** needed
  - Using the **Parallel implementation**, we could also **reduce the propagation time delays**;

		Level 0							
		r7	r6	r5	r4	r3	r2	r1	r0
a0	x^8	1		1			1	1	1
a1	x^9	1	1	1		1			1
a2	x^10		1	1	1		1		1
a3	x^11	1	1	1		1		1	
a4	x^12		1	1	1			1	1
a5	x^13	1	1	1			1	1	
a6	x^14		1	1		1		1	1
a7	x^15	1	1		1		1	1	
a8	x^16					1		1	1
a9	x^17				1		1	1	
a10	x^18			1		1	1		
a11	x^19		1		1	1			
a12	x^20	1		1	1				
a13	x^21	1	1				1	1	1
a14	x^22			1		1			1
a15	x^23		1		1			1	

ENCODER - ARCHITECTURE

- **Input**: 16-bit data word (sent message)
- **Output**: 24-bit CRC-8 Bluetooth check string.

- **Number** of XORS: 58 ⟶ 41 XORS
- **Worst** Case Delay: 9 ⟶ 4 XORS



CHECKER - APPROACH (BIT SERIAL)

- The **CRC8 Checker** serves a crucial role in validating whether the received 24-bit data word has been transmitted **without errors**.

- The previously mentioned **24-bit data word** represents the **transmitted message**, serving as the input for the CRC-8 Encoder (16 bits) **alongside** the **remainder** (8 bits), this remainder is the outcome of dividing the message by the polynomial.

- The design of the checker consists in:
  - a BinCounter 5 bit;
  - a Control Unit;
  - a LFSR (8 FLIP FLOPS in Parallel);
  - a Gate OR 8x1 (comparator);
  - a Flip FlopDPET.