Embedded Systems

Assignment _2

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التاريخ: السبت، 23 ربيع الآخرة، 1446

ARM Cortex-M4 Instruction Set

➢ What Are We Talking About?

We are going to mention one of the saturation instructions of the **Cortex-M4 Instruction Set** and it is **QADD & QDADD**. But before we talk about the instruction itself, what are the saturation instructions?

- ### Saturation Instructions:
  Saturation instructions in ARM Cortex-M4 are designed to handle arithmetic operations in a way that **prevents overflow** by **saturating** values at a maximum or minimum limit. They are particularly useful in **DSP (Digital Signal Processing)** and other high-performance computing applications, where overflow can lead to significant errors.

So now after we know what the Saturation instructions are let's talk about the **QADD & QDADD.**

➢ QADD:

It's simply ADD Two 32-bit signed integers and, if an overflow occurs, it saturates the result to maximum or minimum 32-bit signed integer value.

➔ Positive Value: (0x7FFFFFFF) Hex-decimal, (2147483647) Decimal.

➔ Negative Value: (0x80000000) Hex-decimal, (-2147483647) Decimal.

➢ QDADD:

The only difference between this instruction and the previous one, that this one doubles the value of one register and then adds It to the another one.

This is done as **doubling** may be important for **safety saturation** in some applications such as, **Image processing or Audio processing**, this prevents extreme values that could corrupt the data, especially in iterative operations where overflow could propagate.