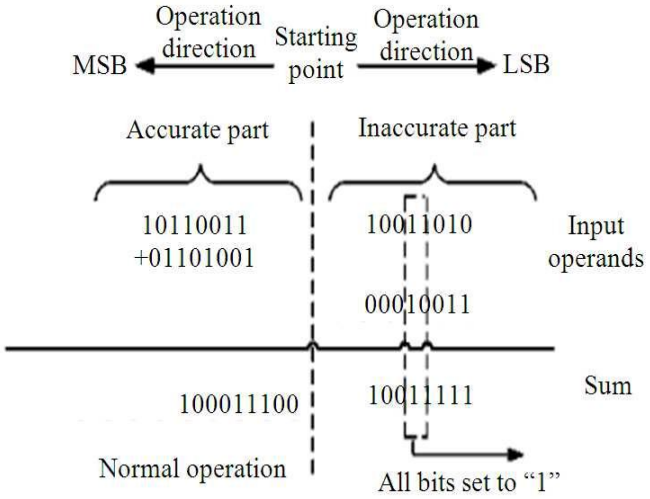

Figure 3: Arithmetic addition

5. Requirement for Error-Tolerant-Adder (ETA)

Increasingly huge data sets and the need for instant response need the adder to be large and fast. The traditional adder like ripple-carry adder (RCA) is thus no longer suitable for large adders because of its low-speed execution. There are different types of adders, like CSK (carry-skip adder), CSL (carry-select adder), and CLA (carry-look-ahead adder), are developed. Likewise, there are so many low-power adder design techniques that have been proposed. Even so, there are always trade-offs between speed and power. For this problem the error-tolerant design can be a possible solution. By sacrificing some accuracy, the error tolerance adder can achieve great improvement in both the power consumption and speed performance.

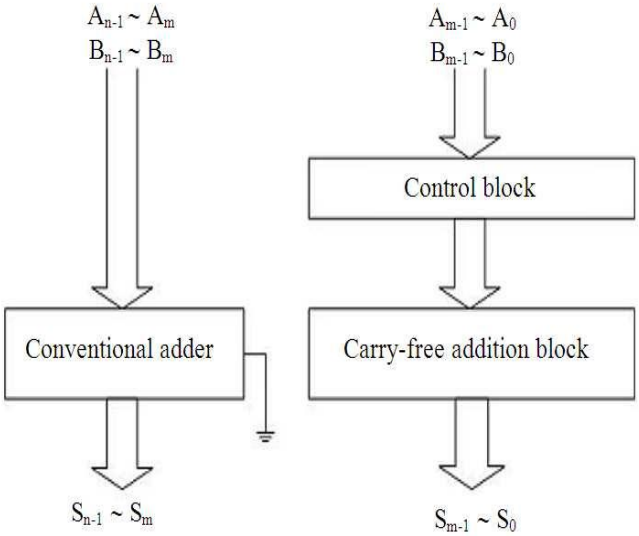

Figure 4: Hardware implementation of the ETA

6. Result

Comparing the simulation results of our proposed ETA with those of the conventional adders (see Table I), it is evident that the ETA performed the best in terms of power consumption, delay, and Power-Delay Product (PDP). The PDP of the ETA is noted to be 66.29%, 77.44%, 83.70%, and 75.21% better than the RCA, CSK, CSL, and CLA, respectively. As for transistor count, the proposed ETA is almost as good as the RCA.

Table 1: Simulation Result for ETA versus Conventional Adders

Type of Adder	Power (mW)	Delay (ns)	PDP (pJ)	PDP saving (%)	Transistor Count
RCA	0.22	4.04	0.89	66.29	896
CSK	0.46	2.90	1.33	77.44	1728
CSL	0.60	3.06	1.84	83.70	2176
CLA	0.51	2.37	1.21	75.21	2208
ETA	0.13	2.29	0.30	N.A.	1006

7. Conclusion

In this paper, error tolerance is introduced in VLSI design. A new type of adder, the error-tolerant adder, which have certain amount of accuracy for significant power saving and performance improvement, is proposed. The possible applications of the ETA fall mainly in areas where there is no strict requirement on accuracy or where super low power consumption and high-speed performance are more important than accuracy. We can take an example, in the DSP application for portable devices such as cell phones and laptops.

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