**APPROXIMATE REVERSE CARRY PROPAGATE ADDER FOR ENERGY-EFﬁCIENT DSP APPLICATIONS**

**Abstract:**

In this paper, a reverse carry propagate adder (RCPA) is presented. In the RCPA structure, the carry signal propagates in a counter-ﬂow manner from the most signiﬁcant bit to the least signiﬁcant bit; hence, the carry input signal has higher signiﬁcance than the output carry. This method of carry propagation leads to higher stability in the presence of delay variations. Three implementations of the reverse carry propagate full-adder (RCPFA) cell with different delay, power, energy, and accuracy levels are introduced. The proposed structure may be combined with an exact (forward) carry adder to form hybrid adders with tunable levels of accuracy. The design parameters of the proposed RCPA implementations and some hybrid adders realized utilizing these structures are studied and compared with those of the state-of-the-art approximate adders using HSPICE simulations in a 45-nm CMOS technology. The results indicate that employing the proposed RCPAs in the hybrid adders may provide, on average, 27%, 6%, and 31% improvements in delay, energy, and energy-delay-product while providing higher levels of accuracy. In addition, the structure is more resilient to delay variation compared to the conventional approximate adder. Finally, the efﬁcacy of the proposed RCPAs is investigated in the discrete cosine transform (DCT) block of the JPEG compression and ﬁnite-impulse response (FIR) ﬁlter applications. The investigation reveals 60% and 39% energy saving in the DCT of JPEG and FIR ﬁlter, respectively, for the proposed RCPAs.

**Index Terms**—Accuracy, approximate adder, digital signal processing (DSP), energy efﬁcient, reverse carry propagate adder (RCPA).

**TOOLS:**

1. **XilinxISE 14.7**

**LANGUAGE:**

1. **VerilogHDL**