Abstract:

Approximate adders are widely being advocated as a means to achieve performance gain in error resilient applications. In this paper, a generic methodology for analytical modeling of probability of occurrence of error and the Probability Mass Function (PMF) of error value in a selected class of approximate adders is presented, which can serve as performance metrics for the comparative analysis of various adders and their configurations. The proposed model is applicable to approximate adders that comprise of subadder units of uniform as well as non-uniform lengths. Using a systematic methodology, we derive closed form expressions for the probability of error for a number of state-of-the-art high-performance approximate adders. The probabilistic analysis is carried out for arbitrary input distributions. It can be used to study the dependence of error statistics in an adder’s output on its configuration and input distribution. Moreover, it is shown that by building upon the proposed error model, we can estimate the probability of error in circuits with multiple approximate adders. We also demonstrate that, using the proposed analysis, the comparative performance of different approximate adders can be correctly predicted in practical applications of image processing.