

Stochastic Logic

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Abstract

Recent reductions in feature sizes have brought about tremendous random variability in the manufacture of nanoscale circuits. This randomness, however, is a one-time event, where the “dice” are thrown only at the time of manufacture. In this work we look at a different type of randomness in nanoscale circuits, where the “dice” are thrown continuously to provide a time varying, stochastic state of logic elements. The proposed stochastic logic is synthesized from bistable switches, whose state switches from ON to OFF, with a known, but not specified, probability. The physical mechanism for the bistability is thermal noise in the ubiquitous double well potential encountered in a variety of nanoscale structures and physical environments. Recent advances in synthesis methodology have shown that the probability of a logic gate can be specified from any underlying probability of the individual switches. The ability to synthesize logic with precise, designer specified probability enables a new paradigm for logic design. In this talk I will describe the concept of stochastic logic, its basic synthesis from bistable switches and discuss some possible applications of this emerging technology.