Null Convention Logic and its Applications

Weidong Kuang

Abstract: Asynchronous circuits, also called clockless or self-timed circuits, are a class of digital logic circuits which do not have global clocks. While the research activities on this topic date back to the 1950s, extensive studies and developments in both academia and industry began in 1990s. As VLSI technology entered the submicron/nanometer era, asynchronous circuits have demonstrated several advantages over their synchronous counterparts, such as low power, low electromagnetic interference (EMI) and robustness.

Null Convention Logic (NCL) is one of the widely accepted paradigms of asynchronous circuits. This talk will present the basic concepts of NCL and its applications. Firstly, the fundamentals of NCL will be introduced, such as data representation, handshake protocol, basic circuit elements (threshold gates) and their transistor-level design. Then the VHDL-based design methodology will be presented to explain how a complicated NCL circuit is actually designed using commercial Electronic Design Automation (EDA) tools. Lastly, the presentation will identify applications and future opportunities of NCL.