

A Brave New World ... Manufactured with Atomic Precision



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Science has explained nothing; the more we know the more fantastic the world becomes and the profounder the surrounding darkness.

Aldous Huxley

Abstract

With the steadfast progress of advanced CMOS nodes of single digit nanometers, as well as the mind-blowing progress achieved by the latest AI and quantum chips, computers are being rethought, reanalyzed, and in fact reborn – as clearly stated in late 2015 that we should “*create a new type of computer that can proactively interpret and learn from data, solve unfamiliar problems using what it has learned, and operate with the energy efficiency of the human brain*” ([Nanotechnology-inspired grand challenge future computing](#)). The progress which has been made is “standing on the shoulders” of the most advanced technologies relying on atomic precision manufacturing. That is why this talk will focus on the latest envisaged transistors as well as other (exotic) switching devices, and on how we could sustain progress well into the next decade. Besides the scientific and technologic roadblocks, the latest economic and geopolitical constraints will also be mentioned, the main conclusion being that a rebooting/rethinking/reassessing of how we should design and implement our future computing systems (focusing on arrays of devices like, e.g., FinFET, MBCFET, GAA, but also various types of qubits) is both timely but also critical.

Valeriu Beiu received the MSc in CE from the University “Politehnica” Bucharest (UPB) in 1980, and the PhD *summa cum laude* in EE from the Katholieke Universiteit Leuven (KUL) in 1994. Since graduating he has been with the Research Institute for Computer Techniques, UPB, KUL, King’s College London, Los Alamos National Lab, Rose Research, Washington State University, United Arab Emirates University, and “Aurel Vlaicu” University of Arad. His research interests have constantly been on biological-/neural-inspired circuits and brain-inspired architectures (low-power, highly reliable), being funded at over US\$ 51M, while publishing over 300 papers (over 50 invited and 20 patents) as well as giving over 220 invited talks, and organizing over 130 conferences. Dr. Beiu has received 5 fellowships and 9 best paper awards, and is an IEEE Senior Member since 1996. He was an Associate Editor of the *IEEE Trans. Neural Nets* (2005-2008), the *IEEE Trans. VLSI Systems* (2011-2015), and the *Nano Communication Networks* (2010-2016), and was lately included in the list of “top 2% scientists” by Stanford.