IEEE Central Coast Event – 17 July 2019 @ 6PM

Professor Dmitri Strukov Ph. D. – UCSB ECE: Alternative Computing with Memristors

FREE EVENT

Location – Goleta Valley Library

500 N. Fairview Avenue, Goleta, CA 93117

6:00 PM – Complimentary Buffet

6:25 PM – Central Coast Status

6:30 PM – Professor Dmitri Strukov's Presentation

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Alternative Computing with Memristors

By now, there have been many demonstrations of resistive switching ("memristive") devices based on organic, chalcogenide, transition metal-oxide and silicon materials and involving different physical switching mechanisms, such as phase-change transitions and modulation of the ionic concentration profiles by electrical and/or thermal forces. The conductance of properly engineered memristors can be continuously tuned with relatively large electrical bias, and retained, effectively indefinitely, when small stress is applied. Such analog nonvolatile memory functionality and extremely high device density achieved by lateral scaling and/or monolithical vertical integration enable many new exciting applications of memristors in neuromorphic and alternative types of computing.

In my talk, I will review several such applications based on metal-oxide memristors which were a recent focus of my group. This includes stateful material implication logic, which was originally suggested by Hewlett Packard Laboratories group. In our work, we showed that 3D version of this logic allows resolving Feynman grand challenge of implementing 8-bit adder in a volume smaller than 50-nm cube. I will also review our experimental work on memristor-based security primitives, in which we utilized device variations and their nonlinear I-Vs to demonstrate functionality and physical performance superior to those of conventional approaches. Finally, I will discuss applications of memristors in neuromorphic computing, outlining some of my group's recent experimental work on mixed-signal firing-rate neural networks, which have a potential to greatly exceed conventional implementations in energy efficiency, speed, and density, and spiking neural networks, that allow for compact implementation of training algorithms in the hardware.

Biography:

Dmitri B. Strukov received the M.S. degree in applied physics and mathematics from the Moscow Institute of Physics and Technology, Moscow region, Russia, in 1999, and the Ph.D. degree in electrical engineering from Stony Brook University, Stony Brook, NY, USA, in 2006.

He is currently a Professor of Electrical and Computer Engineering at University of California at Santa Barbara. Prior to joining UCSB Dmitri worked as a postdoctoral associate, first at Stony Brook University (Aug. 2006 – Dec. 2007), and then at Hewlett Packard Laboratories (Jan. 2007 – Jun. 2009) on various aspects of nanoelectronic systems. His research broadly concerns different aspects of computation, in particular addressing questions on how to efficiently perform computation on various levels of abstraction. His current research focus is on hardware implementations of artificial neural networks with emerging memory devices.