Πανεπιστήμιο Κύπρου
University of Cyprus

School of Engineering
Department of Electrical and Computer Engineering

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Department of Electrical and Computer Engineering

Title: « Memristors for Bioinspired Circuit Design»

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Room ΠΤΕΡ Ε113, Old Campus
University of Cyprus

Abstract:
It has long been the aspiration of humans to understand and mimic the exceptional cognitive abilities of living organisms. Despite huge strides in neuroscience and microelectronics, in both understanding and implementing intelligent behaviour, it has to be acknowledged that this quest is still at its infant stage. The basic element of CMOS computing, the transistor, has evolved as Moore's law predicted, yet through ever more powerful IC technology we are still unable to match the capabilities of even some of nature's simplest organisms. This is the conundrum that biomimetic computer architecture seeks to resolve. And in order to realise bioinspired circuits, we first need to develop synapse equivalents. In the past, memristor circuits were built, but suffered from either large topologies or excessive area and power requirements. Memristors, a class of devices postulated in 1971 and fabricated in 2008, are the perfect candidates for implementing electronic synapses, as part of the Hodgkin-Huxley neuron model, or even executing Hebbian learning or exhibiting spike-timing-dependent plasticity (STDP). In the process of my thesis, memristors, the basic building blocks of bio-inspired architecture have been built and investigated, so that they can be incorporated in the design and fabrication of novel neural circuits. This presentation will focus on the modelling, fabrication and characterisation of memristive devices, as well as the integrated circuit design. An introduction to the novel memristive devices that have been fabricated will be presented. These include nickel titanium smart alloy and copper/tantalum pentoxide memristive devices. This will be followed by an overview of the extensive characterisation and modelling that has been performed in order for these structures to be modelled. Finally, the steps currently being undertaken for construction of neural circuits realising the Hodgkin-Huxley model and exploring Hebbian learning and STDP will be summarised.

Biography:
Evripides Kyriakides is currently a PhD student at the University of Cyprus. He received his Masters degree in Electrical Engineering, majoring in Electrophysics, in 2005 from the University of Southern California and received his Bachelors degree in Electrical Engineering in 2003 from the University of California, Los Angeles. In 2008 Mr Kyriakides joined the University of Cyprus as a researcher/PhD candidate. Since 2010 he has been working on a research project funded by the Cyprus Research Promotion Foundation, PENEK, focusing on memristive devices and neuromorphic architecture, towards his doctorate degree. His research interests are focused mainly on modelling, fabrication and characterisation of memristive devices and neuromorphic architecture. He has participated in a number of

conferences and published his work in esteemed peer-reviewed international conferences and journals. Mr Kyriakides is a member of the KIOS research centre and the IEEE Electron Devices Society.