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ENGINEERING PRODUCT DEVELOPMENT

Discovery

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Engineering Product Development (EPD) Pillar!

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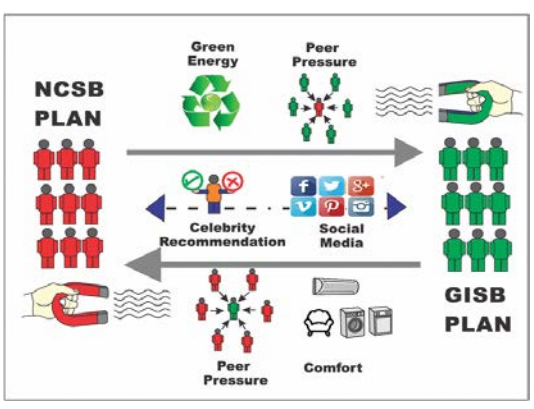
April 2016

DEMAND RESPONSE

Understanding Customer Behaviour in Multi-Tier Demand Response Management Program

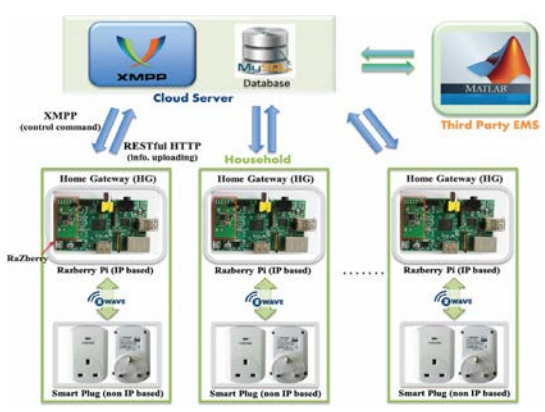


Co-authored by Assistant Professor Yuen Chau

The authors study factors influencing the customer's decision to subscribe to a certain demand response management (DRM) scheme. They then came up with a customer behaviour classification that include non-green comfort seeking behavior (NCSB) and green incentive seeking behavior (GISB). Multi-tier DRM plans that make known the incentive and inconvenience for NCSB and GISB customers were considered. Maximum profit margin can be obtained by the grid operator from the DRM only when a predetermined number of customers are in the NCSB and GISB plans. The authors also establish a mathematical framework based on logistic regression. This framework considers both quantifiable and unquantifiable customer behaviour features.

Source: IEEE Access (December 2015)

Demand Response Management for Residential Smart Grid: From Theory to Practice



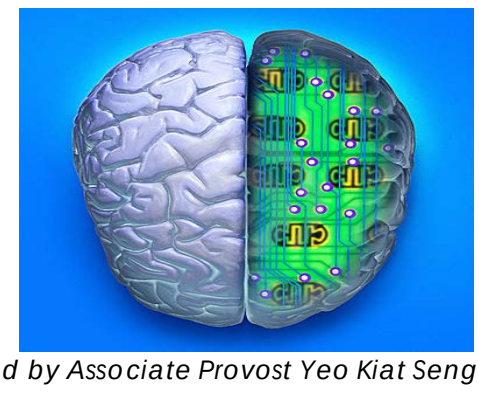
Co-authored by Head of Pillar Kristin Wood and Assistant Professor Yuen Chau

Past studies looked into demand response management (DRM) schemes to manage energy for residential buildings in a smart grid. But the emphasis of most of them is on the theoretical design of DRM schemes without testing the proposed schemes in real-life applications. The authors of this article came up with a DRM scheme. They also erected a residential smart grid testbed to test their proposed scheme in real life. Their DRM scheme has two types of customer engagement plans. They are the green savvy plan and green aware plan. The authors' testbed ensures that the proposed DRM scheme is successful and efficient.

Source: IEEE Access (December 2015)

ELECTRONICS ENGINEERING

Design of a Hybrid Neural Spike Detection Algorithm for Implantable Integrated Brain Circuits

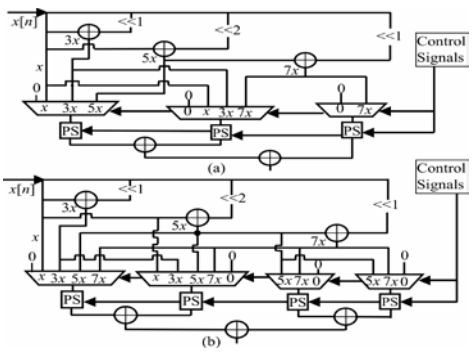


Co-authored by Associate Provost Yeo Kiat Seng

Real time spike detection is the first step in developing spike-sorting aimed at integrated brain circuits interface applications. Spike detection algorithms used include nonlinear energy operator (NEO) and absolute thresholding. Of the two mentioned, NEO performs better. In this article, you will read about a hybrid spike detection algorithm that uses both spike detection algorithms to reduce the power and to ensure a detection rate comparable to that of NEO. First, absolute thresholding is done to detect a potential spike. Then, NEO is used to verify the validity of the detected spike by absolute thresholding. Since NEO is conditionally conducted, this reduces the overall power consumption.

Source: IEEE International Symposium on Circuits and Systems (2015)

Design of Low Complexity Programmable FIR Filters Using Multiplexers Array Optimization



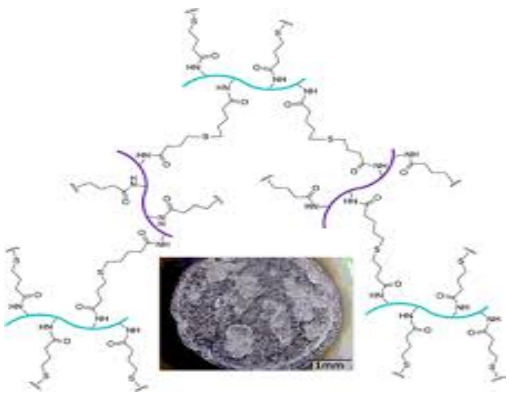
Co-authored by Lecturer Chen Jia Jia

This article introduces a new method to design programmable finite impulse response (FIR) filters in a less complex manner, via optimization on the multiplexer array. Searching approach for efficient common sub-expressions was the method used to design each filter tap with the minimum number of multiplexers. Another multiplexer optimization technique is presented in the article to reduce the number of inputs of multiplexers.

Source: IEEE International Symposium on Circuits and Systems (2015)

MATERIAL SCIENCE

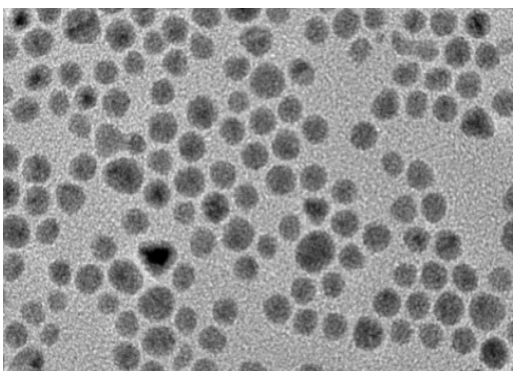
Gelatin hydrogels via thiol-ene chemistry



The authors synthesized a new, gelatinous hydrogel. They accomplished this via cross-linking thiolated gelatin with pentenoyl gelatin, through thiol-ene click chemistry. This new hydrogel was also found to have strong cell compatibility.

Source: Monatshefte für Chemie - Chemical Monthly (March 2016)

Large area sub-100 nm direct nanoimprinting of palladium nanostructures



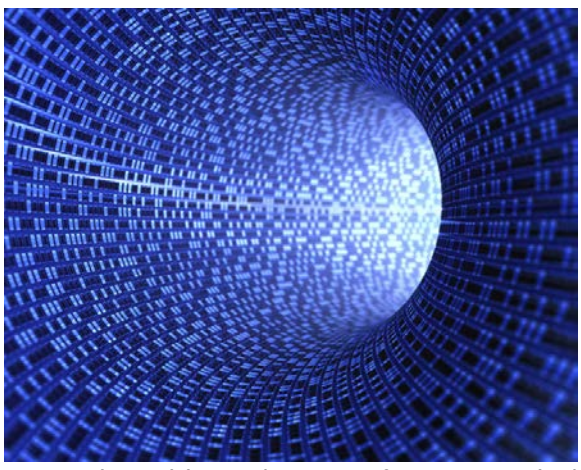
Co-authored by Associate Professor Low Hong Yee

Polydimethylsiloxane (PDMS) molds are used for direct imprinting of metals. This forms a pattern of metal nanoparticles which are then melted to form continuous structures. However, the yield and reproducibility of this method are low for features under 100 nm wide over large areas. The authors show a less complicated method incorporating the addition of a cross-linker ethylene glycol dimethacrylate (EDMA) to a palladium metal precursor, in this article. EDMA features *in situ* free radical polymerization during imprinting. This improves the yield to about100% and also allows for high reproducibility. The palladium nanostructures formed were as small as 35 nm wide on a 1cm^2 area.

Source: RSC Advances (February 2016)

QUANTUM PHYSICS

Fast graph operations in quantum computation

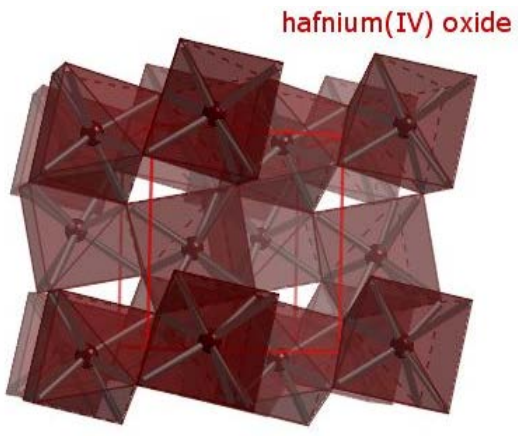


Co-authored by Assistant Professor Joseph Fitzsimons

Entanglement in quantum physics means that several particles are linked together in a manner that the measurement of one particle's quantum state determines the possible quantum states of the other particles. The connection between certain entangled states and graphs was researched upon in the context of measurement-based quantum computation to understand entanglement. This article illustrates that this connection may be used to establish a graph data structure that enables efficient manipulation and comparison of graphs.

Source: Physical Review A(March 2016)

Single vacancy defect spectroscopy on HfO_2 using random telegraph noise signals from scanning tunneling microscopy



Co-authored by Associate Provost Pey Kin Leong

Random telegraph noise (RTN) measurements are done with a standard probe station-based electrical characterization setup. The measured current reflects the simultaneous response of electron capture and emission events at multiple oxygen vacancy defect sites. This article aims to identify defects in the dielectric thin film of HfO_2. HfO_2 has a high dielectric constant, κ. The authors show how RTN can be measured and analysed at the nanoscale level.

Source: Journal of Applied Physics (February 2016)