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IEEE SIGNAL PROCESSING SOCIETY DISTINGUISHED LECTURER PROGRAM

IEEE Signal Processing Society
Malaysia Chapter

13th March 2018

Free Admission

Our speaker:

Prof Geert Leus, IEEE Fellow, EURASIP Fellow, TU Delft

Vice-Chair of the EURASIP Special Area Team on Signal Processing for Multisensor Systems

Associate Editor of Foundations and Trends in Signal Processing

Editor in Chief of EURASIP Signal Processing

Talk title: Graph Signal Processing: Filters and Spectral Estimation

Venue: Bilik Demo 1, P16, Faculty of Electrical Engineering, UTM Johor Bahru Campus

Time: 9:20 am – 10:20 am

Register here:
https://goo.gl/forms/J8UdtAhW4G99tD562

Jointly organised:
IEEE Signal Processing Malaysia Chapter
Faculty Of Electrical Engineering
UTM Skudai

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Razak School of Engineering & Advanced Technology
UTM Razak School

IEEE Signal Processing Society
Malaysia Chapter

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14th March 2018

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Talk 1: Compressive Ultrasound Imaging

- 10 – 11 am

Talk 2: Sparse Sensing for Statistical Interference

- 11:30 am – 12:30 pm

Venue: Razak School, UTM Kuala Lumpur Campus, Room 6, Level 14, Menara Razak

Register here: https://goo.gl/forms/ApwtUain1SK3HDqv2

Jointly organised:
IEEE Signal Processing Malaysia Chapter
Electrophysiological Research Group
Razak School of Engineering and Advanced Technology

- **Speaker Biography:**
- Prof Geert Leus received the M.Sc. and Ph.D. degree in Electrical Engineering from the KU Leuven, Belgium, in June 1996 and May 2000, respectively. Geert Leus is now an "Antoni van Leeuwenhoek" Full Professor at the Faculty of Electrical Engineering, Mathematics and Computer Science of the Delft University of Technology, The Netherlands. His research interests are in the broad area of signal processing, with a specific focus on wireless communications, array processing, sensor networks, and graph signal processing. Geert Leus received a 2002 IEEE Signal Processing Society Young Author Best Paper Award and a 2005 IEEE Signal Processing Society Best Paper Award. He is a Fellow of the IEEE and a Fellow of EURASIP. Geert Leus was a Member-at-Large of the Board of Governors of the IEEE Signal Processing Society, the Chair of the IEEE Signal Processing for Communications and Networking Technical Committee, a Member of the IEEE Sensor Array and Multichannel Technical Committee, and the Editor in Chief of the EURASIP Journal on Advances in Signal Processing. He was also on the Editorial Boards of the IEEE Transactions on Signal Processing, the IEEE Transactions on Wireless Communications, the IEEE Signal Processing Letters, and the EURASIP Journal on Advances in Signal Processing. Currently, he is the Vice-Chair of the EURASIP Special Area Team on Signal Processing for Multisensor Systems, an Associate Editor of Foundations and Trends in Signal Processing, and the Editor in Chief of EURASIP Signal Processing.

- GRAPH SIGNAL PROCESSING: FILTERS AND SPECTRAL ESTIMATION
- One of the cornerstones of the field of graph signal processing are graph filters, direct analogues of time-domain filters, but intended for signals defined on graphs. In this talk, we give an overview of the graph filtering problem. More specifically, we look at the family of finite impulse response (FIR) and infinite impulse response (IIR) graph filters and show how they can be used for different applications. Next, the concepts of graph stationarity and the graph power spectrum are introduced, which facilitates the analysis and processing of random graph signals. This is a challenging task due to the irregularity of the underlying graph domain. However, it turns out that graph filters can be used to define stationary graph signals and their power spectrum. Methods for estimating the power spectrum are presented, which include nonparametric approaches such as correlograms and periodograms, as well as parametric approaches with as parameters the graph filter coefficients generating the random graph signal. Finally, graph spectral estimation from a limited set of nodes in the graph will be discussed. The presented methods are illustrated in synthetic and real-world graphs.

- **Title:** Compressive Ultrasound Imaging
- Three-dimensional ultrasound is a powerful imaging technique, but it requires thousands of sensors and complex hardware. Very recently, the discovery of compressive sensing has shown that the signal structure can be exploited to reduce the burden posed by traditional sensing requirements. In this talk, we will give an overview of how compressive sensing can be used in ultrasound imaging. As an extreme example, we have designed a simple ultrasound imaging device that can perform three-dimensional imaging using just a single ultrasound sensor. Our device makes a compressed measurement of the spatial ultrasound field using a plastic aperture mask placed in front of the ultrasound sensor. The aperture mask ensures that every pixel in the image is uniquely identifiable in the compressed measurement. Similar masks can also be used on existing ultrasound arrays to increase their coverage from two-dimensional to three-dimensional. Furthermore, instead of using a plastic mask on a single sensor, specific analog combinations of the sensor readings in a sensor array can be made before digitization, leading to a similar cost reduction and image quality. We demonstrate our designs with real experiments and illustrate that compressive ultrasound imaging can pave the way for cheaper, faster, simpler and smaller sensing devices with possible new clinical applications.

Title: Statistical Inference through Sparse Sensing

Ubiquitous sensors generate prohibitively large data sets. Large volumes of such data are nowadays generated by a variety of applications such as imaging platforms and mobile devices, surveillance cameras, social networks, power networks, to list a few. In this era of data deluge, it is of paramount importance to gather only the data that is informative for a specific task in order to limit the required sensing cost, as well as the related costs of storing, processing, or communicating the data. The main goal of this talk is therefore to present topics that transform classical sensing methods, often based on Nyquist-rate sampling, to more structured low-cost sparse sensing mechanisms designed for specific inference tasks, such as estimation, filtering, and detection. More specifically, we present fundamental tools to achieve the lowest sensing cost with a guaranteed performance for the task at hand. Applications can be found in the areas of radar, multi-antenna communications, remote sensing, and medical imaging.