Abstract: Cyber physical systems (CPS) are distributed complex systems that integrate computing, networking, and physical processes to facilitate ubiquitous, intelligent machine-to-machine (M2M) interactions among internet of things (IoT). To realize many grand visions of CPS applications, transformative signal and information processing paradigms are needed.

In this workshop, potential applications of Compressive Sensing (CS) to CPS system information processing will be focused. CS represents an energy efficient way of interacting (sampling) the physical world by integrating data compression and sampling into a single process, and thereby significantly reduces computation overhead and energy waste. Despite this great promise, many key questions and challenges remain to seamlessly integrate the CS technology and the CPS system development. For instance, using CS may generate burst rather than periodic traffic. So the current duty-cycle based wireless sensor network protocols need to be reinvestigated to provide not only low power consumption but also high data transmission performance (QoS).

Keynote Speech:

Title: Compressive Parameter Estimation with Manifolds in Cyber-Physical Systems

Abstract: Manifold models have attracted significant attention in compressive sensing due to their power and flexibility in capturing parametric signal models, which are common in distributed signal processing tasks, and their geometric nature, which makes them easily compatible with compressive sensing measurement schemes. This talk will overview the theoretical principles behind the application of manifold models in compressive parameter estimation and present two example settings that are common in cyber-physical systems: first, we present a compressive data fusion scheme for distributed sensing that leverages manifolds; second, we present a practical compressive measurement design scheme that eschews the baseline choice of random projections and picks a data subsampling scheme that best preserves the relevant manifold structure.

Bio: Marco F. Duarte is an Assistant Professor in the Department of Electrical and Computer Engineering at the University of Massachusetts Amherst. He received the B.Sc. degree in computer engineering (with distinction) and the M.Sc. degree in electrical engineering from the University of Wisconsin-Madison in 2002 and 2004, respectively, and the Ph.D. degree in electrical engineering from Rice University, Houston, TX, in 2009. He was a Postdoctoral Fellow in the Program of Applied and Computational Mathematics at Princeton University, Princeton, NJ, from 2009 to 2010, and in the Department of Computer Science at Duke University, Durham, NC, from 2010 to 2011.

Dr. Duarte received the Presidential Fellowship and the Texas Instruments Distinguished Fellowship in 2004 and the Hershel M. Rich Invention Award in 2007, all from Rice University. He also received an NSF Mathematical Sciences Postdoctoral Research Fellowship from the Institute of Pure and Applied Mathematics at the University of California Los Angeles in 2009. He was coauthor in a paper with C. Hegde and V. Cevher that won the Best Student Paper Award in the 2009 International Workshop on Signal Processing with Adaptive Sparse Structured Representations (SPARS).
List of Papers:
1. Simultaneous Sensing Matrix and Sparsifying Dictionary Optimization for Block-sparse Compressive Sensing
   Shuang Li, Qiuwei Li, Gang Li, Xiongxiong He and Liping Chang
   Zhejiang University of Technology

2. A DirectWideband Direction of Arrival Estimation under Compressive Sensing
   Kai Yu, Ming Yin, Ji’an Luo, Ming Bao, Yu-Hen Hu and Zhi Wang
   Zhejiang University

3. Wideband DOA estimation of frequency sparse sources with one receiver
   Jiawei Zhang, Ming Bao, Xiaodong Li
   Institute of Acoustics, Chinese Academy of Sciences

   Nan Zhou, Xiaoguang Zhao, Min Tan
   Institute of Automation, Chinese Academy of Sciences

5. Measurement-based Analysis of the Effect of Duty Cycle in IEEE 802.15.4 MAC Performance
   François Despaux, Ye-Qiong Song, Abdelkader Lahmadi
   LORIA, Université de Lorraine