

Workshop on “Smart Urban Water Systems – defect localization and acoustic communication in water”

Date: February 12, 2015

Location: Seminar room, 2/F, Lo Ka Chung Building, The Hong Kong University of Science & Technology (HKUST) Jockey Club Institute for Advanced Study (IAS), Hong Kong.

Organisers: MS Ghidaoui of the Department of Civil & Environmental Engineering, HKUST, and R Murch of the Department of Electronic & Computer Engineering, HKUST

Sponsors: The Department of Civil & Environmental Engineering at HKUST; The Department of Electronic & Computer Engineering at HKUST; The Hong Kong University of Science & Technology (HKUST) Jockey Club Institute for Advanced Study (IAS); The School of Engineering at HKUST; The Water Supplies Department (WSD), HKSAR.

Urban water systems (UWS) are the lifeline of 3 billion people globally; however, these vital systems are aging and fraught with deficiencies and inefficiencies. UWS of cities such as New York, London, Toronto, Hong Kong and Shanghai are comprised of numerous devices and thousands of Km of conduits. Such UWS leak sizeable amount of water and are prominent energy consumers and greenhouse gas producers. Pipe failures can paralyze business districts and cause devastating urban floods. Worldwide, UWS are challenged by urban growth and climate change. And yet current methods to diagnose leakage and defects in complex underground UWS networks are highly unsatisfactory.

Water infrastructure has been highlighted as a critical issue both nationally and regionally—in the 2011 “No. 1 document” issued by the Chinese Central Government, the 2011 “Green Quality Living in Greater Pearl River Delta” study, and the 2005 “Total Water Management Policy” of HK Government. Indeed, HK has committed HK\$20B to the rehabilitation and replacement of its water supply infrastructure which is expected to reduce the water and energy wastage from 25 to 15%. Many other countries have critical needs for massive and costly UWS upgrades (e.g., the American Water Works Association estimates that US\$250B is needed in the USA alone over the next 30 years).

The workshop focuses on the use of acoustic waves as a new diagnostic paradigm of urban water systems that will enable timely detection of UWS system defects and proactive mitigation measures, thus ensuring the proper functioning of critical water infrastructures in intelligent cities of the future. The speakers include a leader of the water supply department (WSD) of the Hong Kong SAR and renowned academics in acoustic communication in water, hydraulics of urban water systems, wireless communication, robots for water applications and sensor technology. This workshop is an integral part of our Theme-Based Proposal entitled “Smart Urban Water Supply Systems.”

Program

Welcoming Remarks: 9:00-9:10: Prof JHW Lee, Professor and Vice-President of Research and Postgraduate Studies, HKUST.

Opening Remarks: 9:10-9:25: Ir. SW Chau, Chief Engineer/Dev(1), Water Supplies Department(WSD), Hong Kong SAR.

Introduction to the “Need for Smart Urban Water Supply Systems& the Workshop” project: 9:25-9:50: Prof MS Ghidaoui, HKUST.

Invited Lectures:

- **9:50-10:15:**The Experimental Facility for Wave-based Defect Detection at University of Perugia, Italy: Prof B Brunone, University of Perugia, Italy.

10:15-10:30: Coffee Break

- **10:30-10:55:**Waves as Defect Detection – The Italy Experience: Prof S Meniconi, University of Perugia, Italy.
- **10:55-11:20:**Fluid transients and Fluid-structure Interaction – Issues of Resonance and Noise: Prof AS Tijsseling, Department of Mathematics and Computing Science, Eindhoven University of Technology, The Netherlands.
- **11:20-11:45:** Frequency versus Time Domain Methods for Defect Detection: Prof HF Duan, The Hong Kong PolyU.
- **11:45-12:10:** Underwater Acoustic Communication: Prof YR Zheng, Electrical and Computer Engineering, Missouri University of Science and Technology, USA.

12:10-1:45: Lunch – 2nd floor of Lo Ka Chung Building (same floor as the seminar room where all the talks are held).

- **1:45-2:10:** Digital Communications – Introduction to Key Concepts and their Relations to Acoustic Water Column Channels: Prof RD Murch & V Lau, HKUST.
- **2:10-2:35:** Modern Signal Processing Methods for Sequence Design: Prof DP Palomar, ECE, HKUST.
- **2:35-3:00:** Low Power Sensors for Urban Water System Applications: Prof A Bermak, HKUST.
- **3:00-3:25:** A Probabilistic Framework for solving Inverse Problems, Prof L Katafygiotis, HKUST.

3:25-3:40: Coffee Break

- **3:40-4:05:** Mathematical Challenges in Using Waves as Defect Detection: Prof J Zhou, CUHK.
- **4:05-4:30:** Real-time Data Acquisition for Urban Water Systems: Prof JHW Lee, HKUST.
- **4:30-4:55:** Role of High Frequency Waves in Acoustic Imaging of UWSS: Mr M Louati, HKUST.
- **4:55-5:45:** Open Discussion on the theme-based project “Smart Urban Water Supply Systems”
- **5:45-6:45:** Meeting between team members and colleagues from WSD

Dinner Banquet: 7:30-10:00 – Loaf On, 49 Market Street, Sai Kung. Transport is provided to and from the restaurant. A bus will depart from Lo Ka Chung Building at 6:50.