Theories and Numerics of Inverse Problems

(6 - 17 Aug 2018 & 24 - 28 Sep 2018)

Organizing Committee

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- **Xudong Chen** (National University of Singapore)
- **Zuowei Shen** (National University of Singapore)

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- **Jenn-Nan Wang** (National Taiwan University)
- **Hongkai Zhao** (University of California, Irvine)

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Overview

An inverse problem in science is the process of calculating from a set of observation data the causal factors (model parameters) that have produced them. It is called an inverse problem because it starts with the results and then calculates the causes. This is the inverse of a forward problem, which starts with the causes and then calculates the results. Inverse problems arise in many areas of science including mathematics, engineering, medicine, physics, and geophysics. In the last twenty years the active research carried out in the field of inverse problems has made it become an active area of modern applied mathematics and one of the most interdisciplinary fields of science.

Inverse problems are typically ill posed, as opposed to the well-posed problems more typical in the corresponding forward problems. Of the three conditions for a well-posed

problem suggested by J. Hadamard (existence, uniqueness, stability of the solution), the condition of stability is most often violated. While inverse problems are often formulated in infinite dimensional spaces, in practice they have to be recast in discrete form when we numerically solve them. For ill-conditioned inverse problems, regularization should be used by introducing mild assumptions on the solution or other a priori information.

This program consists of one workshop, one tutorial, and one conference on the latest developments in inverse problems, which intends to bring together scientific researchers working in the field of theories and numerics of inverse problems to discuss recent developments and new challenges in this fascinating field.

Activities »

- **Tutorial on Calderon's Problem: Visibility and Invisibility**: 6-10 August 2018
  Organisers: Habib Ammari (ETH Zurich) and Xudong Chen (National University of Singapore)
  Speaker: Gunther Uhlmann, University of Washington, USA and HKUST Jockey Club Institute for Advanced Study, Hong Kong
- **The 9th International Conference on Inverse Problems and Related Topics**: 13-17 August 2018
  Organisers: Xudong Chen (National University of Singapore), Jin Cheng (Fudan University), Benny Y.C. Hon (City University of Hong Kong), June-Yub Lee (Ewha Womens University), Jijun Liu (Southeast University), Masahiro Yamamoto (University of Tokyo) and Jenn-Nan Wang (National Taiwan University)
  Background:
  The International Conference on Inverse Problems and Related Topics (ICIP) conference series were previously held in Hong Kong (2002), Shanghai (2004), Hokkaido (2006), Daejeon (2009), Hong Kong (2010), Nanjing (2012), Taipei (2014), and Seoul (2016). This conference features speakers from both theoretical (mathematics) and applied (engineering) aspects of inverse problems. It aims to strengthen the interaction and, most importantly, to nurture collaborations between two groups of scientists. In addition, one of the focuses of the conference is to promote young scholars in inverse problems in the Asia-Pacific region.
- **Workshop on Qualitative and Quantitative Approaches to Inverse Scattering Problems**: 24-28 September 2018
  Organisers: Gang Bao (Zhejiang University), Xudong Chen (National University of Singapore), Hui Ji (National University of Singapore), Zuowei Shen (National University of Singapore) and Hongkai Zhao (University of California, Irvine)
  Background:
  Radar and sonar systems are of increasing interest in many applications where the aim is to characterize targets in a qualitative or quantitative way. Compared with the increasing importance of inverse scattering problems, the research in this area is still in the nascent stage. Inverse scattering technique is one of the key approaches to improve the image resolution. Theories and numerics of both qualitative and quantitative approaches will be central topic in this workshop. In

particular, representation of signal also plays an important role in quantitative approaches to inverse problems. A suitable system for representing signals will eliminate or alleviate the ill-posedness of inverse problems.

- **Public Lecture**: 16 August 2018, 6:30pm - 7:30pm
  Inverse Problems and Harry Potter's Cloak
  Gunther Uhlmann, University of Washington, USA and HKUST Jockey Club Institute for Advanced Study, Hong Kong
  Venue: AI Singapore, Innovation 4.0, Seminar Room, Level 1, 3 Research Link, Singapore 117602
- **IMS Distinguished Visitor Lecture Series**
  - Gunther Uhlmann, University of Washington, USA and HKUST Jockey Club Institute for Advanced Study, Hong Kong

Please note that our office will be closed on the following public holiday.
- 9 Aug 2018, Singapore National Day.

Venue:

- IMS Auditorium

Registration »

List of Participants »

Media »