Abstract: We consider two regularized transformation-optics cloaking schemes for scattering problems. Both schemes are based on the blowup construction with the generating sets being, respectively, a generic curve and a planar subset. We derive sharp asymptotic estimates in assessing the cloaking performances of the two constructions in terms of the regularization parameters and the geometries of the cloaking devices. The first construction yields an approximate full-cloak, whereas the second construction yields an approximate partial-cloak. Moreover, by incorporating properly chosen conducting layers, both cloaking constructions are capable of nearly cloaking arbitrary scattering contents.
2. **Yuliang Wang**  
   Department of Mathematics, Hong Kong Baptist University, Hong Kong SAR.  
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**Title:**  
A Gesture-based Instruction and Input Device Using Acoustic Waves

**Abstract:**  
A novel method is proposed for the recognition of gestures using acoustic waves. The gestures are modeled by acoustic scatterers whose shapes are drawn from a prescribed dictionary and the recognition is modeled as an inverse acoustic scattering problem. The incident wave is generated from a fixed point exterior of the scatterer and the scattered field is measured at a bounded surface containing the source point. The recognition algorithm consists of two steps and requires two incident wave of different wavenumber. The approximate location of the scatterer is firstly determined by using the measured data at small wavenumber and the shape of the scatterer is then identified using the computed location of the scatterer and the measured data at a regular wavenumber. Numerical experiments show the proposed method is computationally efficient and works with full or phaseless backscattering data of small aperture.
3. Habing Wang  
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Title: The direct and inverse scattering problems with oblique derivative boundary condition

Abstract: In this talk, we consider scattering problems with oblique derivative boundary condition. Different from the well-studied scattering problems with Dirichlet, Neumann and impedance boundary conditions, the boundary condition in our new model involves a linear combination of the normal and tangential derivatives of the wave field with complex coefficient. Compared with the classical scattering models, the tangential derivative on the obstacle boundary leads to some essential differences such as the symmetric property of the Green function and the reciprocity principle of the scattering data. Both the direct and inverse scattering problems with oblique derivative boundary condition are investigated in this talk.
Title: Resonance and scattering in bubbly media

Abstract: We derive an original formula for the Minnaert resonances of bubbles of arbitrary shapes. The derivations use layer potential techniques and Gohberg-Sigal theory. A mathematical justification of the monopole approximation for scattering of acoustic waves from bubbles at their Minnaert resonant frequency is also provided. The main finding of this paper are illustrated with a few numerical examples in two dimensions.
Title: Inverse Random Source Scattering Problems

Abstract: This talk concerns the source scattering problems for acoustic wave propagation, which is governed by the two- or three-dimensional stochastic Helmholtz equation. As a source, the electric current density is assumed to be a random function driven by an additive colored noise. Given the random source, the direct problem is to determine the radiated random wave field. The inverse problem is to reconstruct statistical properties of the source from the boundary measurement of the radiated random wave field. In this work, we consider both the direct and inverse problems. We show that the direct problem has a unique mild solution via a constructive proof. Using the mild solution, we derive effective Fredholm integral equations for the inverse problem. A regularized Kaczmarz method is developed by adopting multi-frequency scattering data to overcome the challenges of solving the ill-posed and large scale integral equations. Numerical experiments will be shown to demonstrate the efficiency of the proposed method. The framework and methodology developed here are expected to be applicable to a wide range of stochastic inverse source problems.
Title: Detection and classification from electromagnetic induction data

Abstract: I will introduce an efficient algorithm for identifying conductive objects using induction data derived from eddy currents. The method consists of first extracting geometric features from the induction data and then matching them to precomputed data for known objects from a given dictionary. The matching step relies on fundamental properties of conductive polarization tensors and new invariance properties introduced in this paper. A new shape identification scheme is developed and tested in numerical simulations in the presence of measurement noise. Resolution and stability properties of the proposed identification algorithm are investigated.
Title: A novel integral equation for scattering by locally rough surfaces and application to the inverse problem: the Neumann case

Abstract: This talk is concerned with the direct and inverse acoustic or electromagnetic scattering problems by a locally perturbed, perfectly reflecting, infinite plane (which is called a locally rough surface) with Neumann boundary condition. We propose a novel integral equation formulation for the direct scattering problem which is defined on a bounded curve (consisting of a bounded part of the infinite plane containing the local perturbation and the lower part of a circle) with two corners. This novel integral equation can be solved efficiently by using the RCIP method introduced previously by Johan Helsing and is capable of dealing with large wave number cases. For the inverse problem, we propose a Newton iteration method to reconstruct the local perturbation of the plane from multiple frequency far-field data, based on the novel integral equation formulation. Numerical examples are carried out to demonstrate that our reconstruction method is stable and accurate even for the case of multiple-scale profiles.
Title: A Fast and Robust Sampling Method for Shape Reconstruction in Inverse Acoustic Scattering Problems

Abstract: We propose a new direct sampling method for shape reconstruction in inverse scattering problems. Theoretically, we show that our indicator functional has a lower bound for sampling points inside scatters, which is the first theory result of indicators of direct sampling methods for sampling points inside scatters. Numerically, only inner products are involved in the computation, thus our method is very fast and robust against measurement noise from the numerical point of view. The recovering scheme works independently of the physical properties of the underlying scatters. There might be several components with different physical properties, or with different scalar sizes, presented simultaneously.

Reference:
X. Liu, A Fast and Robust Sampling Method for Shape Reconstruction in Inverse Acoustic Scattering Problems, submitted, 2016. available on 
http://www.escience.cn/people/xdliu/index.html
Title: Regularized full and partial cloak for thin and plat objects in scattering problems

Abstract: We consider two regularized transformation-optics cloaking schemes for scattering problems. Both schemes are based on the blowup construction with the generating sets being, respectively, a generic curve and a planar subset. We derive sharp asymptotic estimates in assessing the cloaking performances of the two constructions in terms of the regularization parameters and the geometries of the cloaking devices. The first construction yields an approximate full-cloak, whereas the second construction yields an approximate partial-cloak. Moreover, by incorporating properly chosen conducting layers, both cloaking constructions are capable of nearly cloaking arbitrary scattering contents.
10. Kai Zhang
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Title: Numerical method for stochastic interface grating problem

Abstract: In this talk, we present an efficient algorithm to solve the stochastic interface grating problems based on a combination of the shape derivatives, the low-rank approximation, and the weak Galerkin method. By using the asymptotic perturbation approach via shape derivative, we estimate the expectation and the variance of the stochastic solution in terms of perturbation magnitude. For the deterministic equations approximating the expectation, we propose the weak Galerkin method to capture highly complex solutions exhibiting oscillations with high resolution near the interface. For the variance, an efficient low-rank approximation based on pivoted Cholesky decomposition is proposed to compute the two-point correlation function to approximate the second moment of stochastic interface grating problem. The numerical experiments verify the efficiency of our algorithms. This is the jointed work with Prof. G. Bao (ZJU), Prof. Y.Z. Cao (UA), and Dr. Y.L. Hao (JLU).
11. Jun Zou
Department of Mathematics, The Chinese University of Hong Kong, Hong Kong SAR, zou@math.cuhk.edu.hk

Title: unavailable at the moment

Abstract:
Title: A Multilevel Sampling Method for Detecting Sources in a Stratified Ocean Waveguide

Abstract. In the reconstruction process of sound waves in a 3D stratified waveguide, a key technique is to effectively reduce the huge computational demand. In this work, we propose an efficient and simple multilevel reconstruction method to help locate the accurate position of a point source in a stratified ocean. The proposed method can be viewed as a direct sampling method since no solutions of optimizations or linear systems are involved. The novel method exhibits several strengths: fast convergence, robustness against noise, advantages in computational complexity and applicability for a very small number of receivers. This is the jointed work with Yongzhi Xu and Jun Zou.
Title: MUSIC algorithm for imaging perfectly conducting crack in limited-view inverse scattering problem

ABSTRACT: This study examines mathematical representation of well-known MUltiple SIgnal Classification (MUSIC) algorithm to image the shape of arc-like perfectly conducting crack from scattered field data collected within the so-called Multi-Static Response (MSR) matrix in limited-view inverse scattering problem. For this purpose, we establish a relationship between the MUSIC imaging functional and an infinite series of Bessel functions of integer order of the first kind. This relationship is based on the so-called physical factorization of MSR matrix. Various results of numerical simulation are presented in order to support the identified structure of MUSIC. Although a priori information of the target is needed, we examine a least condition of range of incident and observation directions to apply MUSIC in the limited-view problem.