ICCM 2020 Online Series of Conferences on Applied Math

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Section 3: August 2020

Time: August 6, 8:00-9:00 AM (Beijing time) Lecture No. 20200806-10			
Lecture website (zoom): https://zoom.com.cn/j/63698277532 **ID:** 63698277532 **Password:** 20200806			
Speaker	Chi-Wang Shu	**Affiliation**	Brown University, USA
Title: Inverse Lax-Wendroff Procedure for Numerical Boundary Conditions			
Abstract: When solving partial differential equations, finite difference methods have the advantage of simplicity, however they are usually only designed on Cartesian meshes. In this talk, we will discuss a class of high order finite difference numerical boundary condition for solving hyperbolic Hamilton-Jacobi equations, hyperbolic conservation laws, and convection-diffusion equations on complex geometry using a Cartesian mesh. The challenge results from the wide stencil of the interior high order scheme and the fact that the boundary may not be aligned with the mesh. Our method is based on an inverse Lax-Wendroff procedure for the inflow boundary conditions coupled with traditional extrapolation or weighted essentially non-oscillatory (WENO) extrapolation for outflow boundary conditions. The schemes are shown to be high order and stable, under the standard CFL condition for the inner schemes, regardless of the distance of the first grid point to the physical boundary, that is, the ``cut-cell'' difficulty is overcome by this procedure. Recent progress in nonlinear conservation laws with sonic points, and a conservative version of the method, will be discussed. Numerical examples are provided to illustrate the good performance of our method.			
Short Bio: Professor Chi-Wang Shu received his B.S. degree in Mathematics from the University of Science and Technology of China in 1982 and his Ph.D. degree in Mathematics from University of California at Los Angeles in 1986. Since 1987 he has been at the Division of Applied Mathematics of Brown University, as Professor since 1996, as Chair of the Division of Applied Mathematics between 1999 and 2005, and as the Theodore B. Stowell University Professor since 2008. In 1995 he received the first Feng Kang Prize of Scientific Computing from the Chinese Academy of Sciences. In 2007 he received the SIAM/ACM Prize in Computational Science and Engineering for the development of numerical methods that have had a great impact			

on scientific computing, including TVD temporal discretization, ENO and WENO finite difference schemes, discontinuous Galerkin methods, and spectral methods (from the prize citation). Professor Shu was selected in 2009 as an inaugural Fellow of the Society for Industrial and Applied Mathematics (SIAM), and in 2012 as an inaugural Fellow of the American Mathematical Society (AMS). In 2014 he was an Invited Speaker of the International Congress of Mathematicians (ICM) held in Seoul. Currently Professor Shu is the Chief Editor of the Journal of Scientific Computing, the Chief Editor of Communications on Applied Mathematics and Computation, and a Co-Chief Editor, Editor or Associate Editor of several other research journals including Mathematics of Computation and Journal of Computational Physics.

Time: August 13, 15:00-16:00 PM (Beijing time) Lecture No. 20200813-11

Lecture website (zoom): https://zoom.com.cn/j/67665194189

ID: 67665194189 **Password:** 20200813

Speaker	Habib Ammari	**Affiliation**	ETH Zürich, Switzerland

Title: Wave Interaction with Subwavelength Resonators

Abstract: In this lecture, the speaker reviews recent results on subwavelength resonances. His main focus is on developing a mathematical and computational framework for their analysis. By characterizing and exploiting subwavelength resonances in a variety of situations, he proposes a mathematical explanation for super-focusing of waves, double-negative metamaterials, Dirac singularities in honeycomb subwavelength structures, and topologically protected defect modes at the subwavelength scale. He also describes a new resonance approach for modelling the cochlea which predicts the existence of a travelling wave in the acoustic pressure in the cochlea fluid and offers a basis for the tonotopic map.

Short Bio: Habib Ammari is a Professor of Applied Mathematics at ETH Zürich. Before moving to ETH, he was a Director of Research at the Department of Mathematics and Applications at Ecole Normale Supérieure in Paris. He received a Bachelor's degree in 1992, a Master's degree in 1993, and a Ph.D. in applied mathematics in 1995, all from the Ecole Polytechnique, France. Following this, he received a Habilitation degree in Mathematics from the University of Pierre & Marie Curie in Paris three years later. Habib Ammari is a world leading expert in wave propagation phenomena in complex media, mathematical modelling in photonics and phononics, and mathematical biomedical imaging. He has published more than two hundred research papers, eight high profile research-oriented books and edited eight books on contemporary issues in applied mathematics. He has advised thirty four PhD students and twenty three postdoctoral researchers. Habib Ammari was awarded a European Research Council Advanced Grant in 2010 in recognition of the excellence of his achievements and his outstanding research program in mathematical imaging. He was named the 2013 winner of the Kuwait Prize in Basic Sciences and received this prestigious prize from His Highness the Emir of Kuwait. In 2015, he was the recipient of the Khwarizmi International Award in Basic Sciences, which is the highest honor accorded by His Excellency the President of the Islamic Republic of Iran for intellectual achievement. Habib Ammari has been a fellow of the Tunisian Academy of Sciences, Letters and Arts since 2015 and of the European Academy of Sciences since 2018. He is also listed as an ISI highly cited researcher.

Time: August 20, 8:00-9:00 AM (Beijing time) Lecture No. 20200820-12

Lecture website (zoom): https://zoom.com.cn/j/63159023950
ID: 63159023950 **Password:** 20200820

Speaker	Li Wang	**Affiliation**	University of Texas at Arlington, USA

Title: Large-Scale Semi-supervised Learning via Graph Structure Learning over High-dense Points

Abstract: We focus on developing a novel scalable graph-based semi-supervised learning (SSL) method for a small number of labeled data and a large amount of unlabeled data. Due to the lack of labeled data and the availability of large-scale unlabeled data, existing SSL methods usually encounter either suboptimal performance because of an improper graph or the high computational complexity of the large-scale optimization problem. In this paper, we propose to address both challenging problems by constructing a proper graph for graph-based SSL methods. Different from existing approaches, we simultaneously learn a small set of vertexes to characterize the high-dense regions of the input data and a graph to depict the relationships among these vertexes. A novel approach is then proposed to construct the graph of the input data from the learned graph of a small number of vertexes with some preferred properties. Without explicitly calculating the constructed graph of inputs, two transductive graph-based SSL approaches are presented with the computational complexity in linear with the number of input data. Extensive experiments on synthetic data and real datasets of varied sizes demonstrate that the proposed method is not only scalable for large-scale data, but also achieve good classification performance, especially for extremely small number of labels.

Short Bio: Dr. Li Wang is currently an assistant professor with Department of Mathematics and Department of Computer Science Engineering, University of Texas at Arlington, Texas, USA. She worked as a research assistant professor with Department of Mathematics, Statistics, and Computer Science at University of Illinois at Chicago, Chicago, USA from 2015 to 2017. She worked as the Postdoctoral Fellow at University of Victoria, BC, Canada in 2015 and Brown University, USA, in 2014. She received her Ph.D. degree in Department of Mathematics at University of California, San Diego, USA, in 2014. Her research interests include data science, large-scale optimization and machine learning.

Time: August 27, 15:00-16:00 (Beijing time) Lecture No. 20200827-13

Lecture website (zoom): https://zoom.com.cn/j/69287082106
ID: 69287082106 **Password:** 20200827

Speaker	Jun Zou	**Affiliation**	The Chinese University of Hong Kong, China

Title: Direct sampling methods for general nonlinear inverse problems

Abstract: In this talk we will address the up-to-date developments of direct sampling methods (DSMs) for solving general nonlinear inverse problems of PDEs. DSMs were initially proposed for inverse acoustic scattering problems, using far-field or near-field data, then extended for inverse Maxwell scattering problems, and further developed for non-wave type inverse problems, including EIT, DOT, Radon transform problems as well as recovering moving inhomogeneous inclusions. The DSMs are computationally cheap, highly parallel, and robust against noise, particularly applicable to the cases when very limited data is available. General motivations, principles and justifications of DSMs are presented in this talk. Numerical experiments are demonstrated for various inverse problems.

Short Bio: Prof. Jun Zou is Choh-Ming Li Chair Professor of Mathematics of The Chinese University of Hong Kong , and Chairman of Department of Mathematics. Before taking up his current position in Hong Kong, he had worked two years (93-95) in University of California at Los Angeles as a post-doctoral fellow and a CAM Assistant Professor , worked two and a half years (91-93) in Technical University of Munich as a Visiting Assistant Professor and an Alexander von Humboldt Research Fellow (Germany), and worked two years (89-91) in Chinese Academy of Sciences (Beijing) as an Assistant Professor. Jun Zou was elected as a Fellow of Society for Industrial and Applied Mathematics (SIAM) in 2019.