广东省计算数学学会 2021 年会会议通知（第二轮）

为了推动广东省计算科学发展，加强计算科学人才培养，促进计算科学研究人员之间的交流与合作，广东省计算数学学会、广东省高性能计算学会、广东省计算科学重点实验室定于 2021 年 12 月 18 日举办“广东省计算数学学会 2021 年会”。学会常务理事会议等机构会议在会议期间举行。根据疫情防控的需要，本年度年会采取线上会议的形式。会议相关事宜如下：

一、 主办单位、承办单位

广东省计算数学学会、中山大学计算机学院（软件学院）

二、 协办单位

广东省计算科学重点实验室、广东省高性能计算学会

三、 会议时间

2021 年 12 月 18 日，腾讯会议 ID：732 642 288，密码：1218

四、 会议日程

1、学会年度工作汇报与下年度工作计划；2、邀请报告；

3、青年优秀学术成果奖成果展示；4、学术报告

会议日程及报告简介见本通知附表和附件

五、 联系方式

李启元：13925199300（020-39336519），compsci@mail.sysu.edu.cn

欢迎计算科学学科及相关产业的专家、学者、同学参加！

广东省计算数学学会

2021 年 12 月 10 日

附表：会议日程

12 月 18 日上午 08:30-12:20		腾讯会议 ID:732 642 288 密码:1218	
时间	报告人	题目	主持人
08:30-08:40	邹青松	广东省计算数学学会工作报告	
08:40-09:10	谢小平	Discontinuous Galerkin method for a distributed optimal control problem of time fractional diffusion equation	张海樟
09:10-09:40	钟柳强	A posteriori error estimate for a modified weak Galerkin method solving H(curl)-elliptic problems	
09:40-10:05	胡耀华	Mix Sparse Optimization: Theory and Applications	
10:05-10:30	张　进	Towards Gradient-based Bilevel Optimization in Machine Learning	
Break:10:30-10:40			
10:40-11:05	吴开亮	Geometric Quasilinearization for Analysis and Design of Bound-Preserving Schemes	钟柳强
11:05-11:30	叶国栋	A compressive sensing based image encryption and hiding algorithm	
11:30-11:55	刘晓霞	Nonlocal Low-Rank Model for Image Restoration and Its Proximal Alternating Reweighted Minimization Algorithm	
11:55-12:20	吴乐秦	Parameter Estimation and Variable Selection for Big Systems of Linear Ordinary Differential Equations: A Matrix-Based Approach	

12 月 18 日下午 13:30-17:35		腾讯会议 ID:732 642 288 密码:1218	
时间	报告人	题目	主持人
13:30-14:00	曹外香	A class of efficient spectral methods and error analysis for nonlinear Hamiltonian systems	邹青松
14:00-14:30	李景治	Determining a random Schrödinger equation with unknown source and potential	
14:30-14:55	张　娜	A proximal algorithm with backtracked extrapolation for a class	
14:55-15:20	陈荣亮	High Resolution Multi-organ Hemodynamic Simulation with High Performance Computing	
Break:15:20-15:30			
15:30-15:55	张文龙	A frame work to quantify the uncertainty in general inverse problems with random noise	张庆辉
15:55-16:20	杨钧翔	Efficiently linear and energy-stable numerical method for the H-1-gradient flow based Swift-Hohenberg model with quadratic-cubic nonlinearity on curved surface	
16:20-16:45	贡文波	Deriving locally conservative fluxes from high-order finite element solutions by solving a constrained minimization problem	
16:45-17:10	胡汉章	多孔介质中可压缩渗流驱动问题高效数值算法研究	
17:10-17:35	潘　欢	Orientation Determination of Cryo-EM Images	

附件：报告简介（按报告先后顺序）

Discontinuous Galerkin method for a distributed optimal control problem of time fractional diffusion equation

谢小平 四川大学

This talk is devoted to the numerical analysis of a control constrained distributed optimal control problem subject to a time fractional diffusion equation with non-smooth initial data. The solutions of the state and co-state are decomposed into singular and regular parts, and some growth estimates are obtained for the singular parts. Following the variational discretization concept, a full discretization is applied to the state and co-state equations by using conforming linear finite element method in space and piecewise constant discontinuous Galerkin method in time. Error estimates are derived by employing the growth estimates. In particular, graded temporal grids are adopted to obtain the first-order temporal accuracy. Finally, numerical experiments are provided to verify the theoretical results.

报告人简介

谢小平，四川大学数学学院教授（博导），四川省学术和技术带头人，教育部新世纪优秀人才，德国洪堡学者。研究领域：偏微分方程数值解，有限元法的理论及应用。

学术兼职：中国工业与应用数学学会油水资源数值方法专业委员会副主任委员，中国工业与应用数学学会高性能计算与数学软件专业委员会委员，中国仿真学会集成微系统建模与仿真专业委员会委员，四川省普通本科高等学校教学指导委员会（数学类）秘书长,四川省专家评议委员。

编委：《数值计算与计算机应用》、《高等学校计算数学学报》、《Mathematical Problems in Engineering》、《Numerical Analysis and Applicable Mathematics》、Fractal and Fractional》(Topic editor)。

获奖：教育部自然科学奖二等奖（2021 年，项目名称：几类非标准有限元法的收敛性理论和快速算法）

A posteriori error estimate for a modified weak Galerkin method solving H(curl)-elliptic problems

钟柳强 华南师范大学

In this talk, we design and analysis a modified weak Galerkin (MWG) discretization with a posteriori error estimate for solving H(curl)-elliptic problem. We first introduce a new discrete weak curl operator and the MWG finite element space, then design a MWG discretization. Secondly, we prove optimal error estimates in energy norm. Thirdly, we construct a residual-type error estimator and provide a posteriori error estimate. At last, we present several experiments to verify the theoretical results.

报告人简介

钟柳强，华南师范大学数学科学学院教授、博士生导师。从事偏微分方程的数值求解中的多水平法的设计分析、自适应有限元法理论及其应用。曾获得第 14 届国际数值分析-Leslie Fox 奖、第 14 届美国多重网格法铜山会议论文竞赛奖和全国优秀博士学位论文。先后主持四项国家自然科学基金项目和多项省部级科研基金项目。在 Math. Comp., SIAM J. Numer. Anal., Numer. Linear Algebra Appl. 和中国科学-数学等国内外期刊发表系列论文。

Mix Sparse Optimization: Theory and Applications

胡耀华 深圳大学

In this talk, we will consider a mix sparse optimization problem, that is, sparsity structures at intra-group and inter-group levels are considered simultaneously. This mix sparse structure widely appears in various applications. For the mix sparse optimization problem, we will discuss the nonconvex regularization method, as well as a first-order iterative algorithm, and present its consistency theory, asymptotic theory and convergence theory. Applications to gene regulatory networks and differential optical absorption spectroscopy will be presented.

报告人简介

胡耀华，先后获得浙江大学学士和硕士学位，香港理工大学博士学位（师从杨晓琪教授）。现任深圳大学数学与统计学院副教授，硕士生导师，香港理工大学兼职博士生导师，深圳市海外高层次人才，兼任中国运筹学会－数学规划分会青年理事，广东省运筹学会理事。主要从事连续优化理论与应用研究，主持国家自然科学基金 3 项，省市级科研项目多项。在 SIAM Journal on Optimization, Journal of Machine Learning Research, Inverse Problems, European Journal of Operational Research 等国际学术期刊发表 40 余篇论文，授权 3 项发明专利，开发多个生物信息学工具包/网页服务器。

Towards Gradient-based Bilevel Optimization in Machine Learning

张进 南方科技大学

Recently, Bi-Level Optimization (BLO) techniques have received extensive attentions from machine learning communities. In this talk, we will discuss some recent advances in the applications of BLO. First, we study a gradient-based bi-level optimization method for learning tasks with convex lower level. In particular, by formulating bi-level models from the optimistic viewpoint and aggregating hierarchical objective information, we establish Bi-level Descent Aggregation (BDA), a flexible and modularized algorithmic framework for bi-level programming. Second, we focus on a variety of BLO models in complex and practical tasks are of non-convex follower structure in nature. In particular, we propose a new algorithmic framework, named Initialization Auxiliary and Pessimistic Trajectory Truncated Gradient Method (IAPTT-GM), to partially address the lower level non-convexity. By introducing an auxiliary as initialization to guide the optimization dynamics and designing a pessimistic trajectory truncation operation, we construct a reliable approximation to the original BLO in the absence of lower level convexity hypothesis. Extensive experiments justify our theoretical results and demonstrate the superiority of the proposed BDA and IAPTT-GM for different tasks, including hyper-parameter optimization and meta learning.

报告人简介

张进博士 2007、2010 年本科、硕士毕业于大连理工大学，2014 年博士毕业于加拿大维多利亚大学。2015 至 2018 年间任职香港浸会大学数学系，2019 年初加入南方科技大学数学系。张进博士一直致力于最优化理论和应用研究，代表性成果发表在 Mathematical Programming、SIAM Journal on Optimization、SIAM Journal on Numerical Analysis、Journal of Machine Learning Research、International Conference on Machine Learning、Conference on Neural Information Processing Systems 等有重要影响力的应用数学、机器学习期刊与会议上。张进博士的研究成果获得 2020 年第七届中国运筹学会青年科技奖，主持国家自然科学基金青年与面上项目、香港研究资助局面上项目、广东省自然科学基金杰青项目、深圳市优秀科技创新人才优青项目。

Geometric Quasilinearization for Analysis and Design of Bound-Preserving Schemes

吴开亮 南方科技大学

Solutions to many partial differential equations satisfy certain bounds or constraints. For example, the density and pressure are positive for equations of fluid dynamics, and in the relativistic case the fluid velocity is upper bounded by the speed of light, etc. As widely realized, it is crucial to develop bound-preserving numerical methods that preserve such intrinsic constraints. Exploring provably bound-preserving schemes has attracted much attention and is actively studied in recent years. This is however still a challenging task for many systems especially those involving nonlinear constraints.

Based on some key insights from geometry, we systematically propose an innovative and general framework, referred to as geometric quasilinearization (GQL), which paves a new effective way for studying bound-preserving problems with nonlinear constraints. The essential idea of GQL is to equivalently transfer all nonlinear constraints into linear ones, through properly introducing some free auxiliary variables. We establish the fundamental principle and general theory of GQL via the geometric properties of convex regions, and propose three simple effective methods for constructing GQL. We apply the GQL approach to a variety of partial differential equations, and demonstrate its effectiveness and remarkable advantages for studying bound-preserving schemes, by diverse challenging examples and applications which cannot be easily handled by direct or traditional approaches.

报告人简介

吴开亮,南方科技大学数学系副教授、博士生导师。2011 年获华中科技大学数学学士学位；2016 年获北京大学计算数学博士学位；2016-2020 年先后在美国犹他大学和俄亥俄州立大学从事博士后研究；2021 年 1 月加入南科大、任副教授。研究方向包括计算流体力学与数值相对论、机器学习与数据驱动建模、微分方程数值解、高维逼近与不确定性量化等。研究成果发表在 SINUM、M3AS、Numer. Math.、SISC、J. Comput. Phys.、JSC、ApJS、Phys. Rev. D 等重要期刊上。曾获中国数学会计算数学分会 优秀青年论文奖一等奖（2015）和中国数学会 钟家庆数学奖（2019），入选国家高层次人才计划（青年），主持国家自然科学基金面上项目。

A compressive sensing based image encryption and hiding algorithm

叶国栋 广东海洋大学

Most current image encryption algorithms encrypt plain images directly into meaningless cipher images. Visually, a few of them are vulnerable to illegal attacks on a few sharing platforms or open channels when being transmitted. Therefore, this paper proposes a new meaningful image encryption algorithm based on compressive sensing and information hiding technology, which hides the existence of the plain image and reduces the possibility of being attacked. Firstly, the discrete wavelet transform (DWT) is employed to sparse the plain image. This is followed by confusion operation on pixel positions, where logistic-tent map is employed to produce a confusion sequence. And then the image is compressed and encrypted by compressive sensing to form an intermediate cipher image. Here, measurement matrix is generated using low-dimension complex tent-sine system. To further enhance recovery quality, we suggest that the inter- mediate cipher image be filled with random numbers according to the compression ratio and confusing them to obtain the secret image. Finally, two-dimensional (2D) DWT of the carrier image is performed, followed by singular value decomposition. The singular values of the secret image are embedded into the singular values of the carrier image with certain embedding strength to obtain the final visually mean- ingful encrypted image.

报告人简介

叶国栋，教授、博士、博士生导师、研究生院副院长，中国图象图形学会数字媒体取证与安全专业委会委员、广东海洋大学“南海学者计划”杰出学者人才、广东海洋大学优秀青年骨干教师、广东海洋大学信息安全学科带头人。毕业于香港城市大学获得博士学位、浙江大学博士后，主要从事信息安全、密码学、图像隐私保护、压缩感知等研究。截止目前，主持国家自然科学基金面上项目、国家自然科学基金青年项目、中国博士后科学基金项目、广东省自然科学基金面上项目、广东省科技计划项目、广东省研究生教育创新计划项目、广东省教育厅科研项目（广东省普通高校重点领域专项）等多个课题，发表中国科学院 JCR 分区等高水平论文 40 篇、ESI 高被引论文 4 篇、国家发明专利 2 件、计算机软件著作权多件。

Nonlocal Low-Rank Model for Image Restoration and Its Proximal Alternating Reweighted Minimization Algorithm

刘晓霞 深圳大学

The nonlocal self-similarity of natural images implies that the matrices formed by their nonlocal similar patches are low-rank. By exploiting this low-rank prior, we propose a nonlocal low-rank model for image restoration and develop a proximal alternating reweighted minimization (PARM) algorithm to solve the optimization problem resulting from the model. The proposed nonlocal low-rank model is a nonconvex nonsmooth optimization problem having a patchwise data fidelity and a generalized nonlocal low-rank regularization term. And the proposed PARM algorithm has a proximal alternating scheme with a reweighted approximation of its subproblem. A theoretical analysis of the proposed PARM algorithm is conducted to guarantee its global convergence to a critical point. In application to multiplicative noise removal, numerical results demonstrate that the proposed method outperforms existing methods, such as the benchmark SAR-BM3D method, in terms of the visual quality of the denoised images, and of the PSNR and SSIM values.

报告人简介

刘晓霞，深圳大学数学与统计学院，副研究员。2012 年本科毕业于中山大学数学与计算科学学院；2018 年博士毕业于美国雪城大学（Syracuse University）数学系；2021 年于深圳大学数学与统计学院博士后出站。主要研究方向：图像处理，最优化算法。

Parameter Estimation and Variable Selection for Big Systems of Linear Ordinary Differential Equations: A Matrix-Based Approach

吴乐秦　暨南大学

Ordinary differential equations (ODEs) are widely used to model the dynamic behavior of a complex system. Parameter estimation and variable selection for a “Big System” with linear ODEs are very challenging due to the need of nonlinear optimization in an ultra-high dimensional parameter space. In this talk, we will introduce a parameter estimation and variable selection method based on a matrix-based approach, about its theoretical properties and dramatic numerical improvement compared to classical methods.

报告人简介

吴乐秦，博士、副教授，2007 年本科毕业于北京大学数学科学学院，2012 年博士毕业于中国科学院数学与系统科学研究院，2012-2014 年工作于美国 University of Rochester 生物统计系，2014 年至今工作于暨南大学信息科学技术学院，。目前主持两项国家自然科学基金，研究兴趣为最优化问题的算法设计与分析，微分方程反问题等。

A class of efficient spectral methods and error analysis for nonlinear Hamiltonian systems

曹外香 北京师范大学

In this talk, we investigate efficient numerical methods for nonlinear Hamiltonian systems. Three polynomial spectral methods (including spectral Galerkin, Petrov-Galerkin, and collocation methods) coupled with domain decomposition are presented and analyzed. Our main results include the energy and symplectic structure-preserving properties and error estimates. We prove that the spectral Petrov-Galerkin method preserves the energy exactly while both the spectral Gauss collocation and spectral Galerkin methods are energy conserving up to spectral accuracy. While it is well known that collocation at Gauss points preserves symplectic structure, we prove that the Petrov-Galerkin method preserves the symplectic structure up to a Gauss numerical quadrature error and the spectral Galerkin method preserves the symplectic structure up to spectral accuracy error. Finally, we show that all three methods converge exponentially, which makes it possible to simulate the long time behavior of the system. Numerical experiments indicate that our algorithms are efficient.

报告人简介

曹外香，北京师范大学数学科学学院，副教授，2014 年于中山大学数计学院获得博士学位，2014 年至 2016 在北京计算科学研究中心从事博士后研究， 2016-2017 年中山大学特聘研究员。研究方向为偏微分方程数值解法和数值分析，主要研究有限元方法、有限体积方法，DG 方法等的高效高精度数值计算。 曾获得中国博士后基金一等资助和特别资助，主持国家自然科学青年基金和面上项目。

Determining a random Schrödinger equation with unknown source and potential

李景治 南方科技大学

This talk studies the direct and inverse scattering problem associated with a time-harmonic random Schrödinger equation with a Gaussian white noise source term. We establish the well-posedness of the direct scattering problem and obtain three uniqueness results in determining the variance of the source term, the potential and the mean of the source term, sequentially, by the corresponding far-field measurements. The first one shows that a single realization of the passive scattering measurement can uniquely recover the variance of the source term, without knowing the other two unknowns. The second shows that if active scattering measurement is further used, then a single realization can uniquely recover the potential function without knowing the source term. The last one shows that if full measurements are used, then both the potential and the random source can be uniquely recovered.

报告人简介

李景治，博士毕业于香港中文大学，主要研究方向为数学物理反问题，现为南方科技大学数学系教授，曾任职瑞士联邦理工大学苏黎世，2012 年 6 月加入南方科技大学。目前主要研究领域涉及到反问题理论与计算方法，形状优化与微分形式统一理论，科学计算，有限元方法。

A proximal algorithm with backtracked extrapolation for a class of structured fractional programming

张娜 华南农业大学

In this paper, we consider a class of structured fractional minimization problems where the numerator part of the objective is the sum of a convex function anda Lipschitz differentiable (possibly) nonconvex function, while the denominatorpart is a convex function. By exploiting the structure of the problem, we proposea first-order algorithm, namely, a proximal-gradient-subgradient algorithm withbacktracked extrapolation (PGSA-BE) for solving this type of optimizationproblem. It is worth pointing out that there are a few differences between ourbacktracked extrapolation and other popular extrapolations used in convex andnonconvex optimization. One of such differences is as follows: if the new iterateobtained from the extrapolated iteration satisfies a backtracking condition, thenthis new iterate will be replaced by the one generated from the non-extrapolatediteration. We show that any accumulation point of the sequence generated byPGSA-BE is a critical point of the problem regarded. In addition, by assumingthat some auxiliary functions satisfy the Kurdyka-Lojasiewicz property, we areable to establish global convergence of the entire sequence, in the case where thedenominator is locally Lipschitz differentiable, or its conjugate satisfies the calmness condition. Finally, we present some preliminary numerical results to illustrate the efficiency of PGSA-BE.

报告人简介

张娜博士于 2013 年 12 月毕业于中山大学，获得概率论与数理统计专业博士学位，美国雪城大学联合培养博士。2014.07 在华南农业大学数学与信息学院工作至。研究领域包括最优化理论及算法、信号及图像处理。主持国家基金，2017 论文入选《Inverse Problems》Highlight 论文，2015.09 中国计算数学年会优秀青年论文竞赛一等奖。

High Resolution Multi-organ Hemodynamic Simulation with High Performance Computing

陈荣亮 中国科学院深圳先进技术研究院

Patient-specific blood flow simulations have the potential to provide quantitative predictive tools for virtual surgery, treatment planning, and risk stratification. To accurately resolve the blood flows based on the patient-specific geometry and parameters is still a big challenge because of the complex geometry and the turbulence, and it is also important to obtain the results in a short amount of computing time so that the simulation can be used in surgery planning. In this talk, we will precent some recent results of the multi-organ blood flow simulations with patient-specific geometry and parameters on a large-scale supercomputer. Several mathematical, biomechanical, and supercomputing issues will be discussed in detail. We will also report the parallel performance of the methods on a supercomputer with a large number of processors.

报告人简介

陈荣亮，中国科学院深圳先进技术研究院副研究员。深圳市优青、深圳市海外高层次人才。湖南大学计算数学学士(2006.07)，湖南大学和美国科罗拉多大学联合培养博士(2012.07)。主要从事面向工程应用的并行算法、软件和应用研究工作。研究领域涉及人体血流动力学模拟，航空航天飞行器气动计算，城市污染物扩散模拟等。目前已发表高水平学术论文 50 余篇，主持国自然面上、国自然-澳门联合基金、国家重点研发计划国际合作项目等多项国家和地方级科研项目。

A frame work to quantify the uncertainty in general inverse problems with random noise

张文龙 南方科技大学

In this work, we investigate the regularized solutions and their finite element solutions to the inverse source problems governed by partial differential equations, and establish the stochastic convergence and optimal finite element convergence rates of these solutions, under pointwise measurement data with random noise. The regularization error estimates and the finite elementerror estimates are derived with explicit dependence on the noise level, regularization parameter, mesh size, and time step size, which can guide practical choices among these key parameters in realapplications. The error estimates also suggest an iterative algorithm for determining an optimal regularization parameter. Numerical experiments are presented to demonstrate the effectiveness of the analytical results.

报告人简介

张文龙，南方科技大学访问助理教授，南京大学本科毕业，中国科学院大学研究生，巴黎高等师范学校博士。2017 年 10 月在南方科技大学工作至今。研究方向为反问题、经验过程应用、成像方法、均匀化理论、偏微分方程数值方法等。在 SIAM Journal on Numerical Analysis、Inverse Problems 等杂志发表多项高水平研究成果。主持国家基金项目，入选南方科技大学校长卓越博士后。

Efficiently linear and energy-stable numerical method for the H-1-gradient flow based Swift-Hohenberg model with quadratic-cubic nonlinearity on curved surface

杨钧翔 中山大学

We develop an energy-stable method for solving H-1-gradient flow based Swift-Hohenberg equation with quadratic-cubic nonlinearity on 3D surface. By introducing an appropriate truncated nonlinear potential, we propose second-order time-accurate scheme based on the linear splitting and implicit-explicit Runge-Kutta approaches. A set of triangles is adopted to discretize the curved surface. In each time iteration, we only need to solve some elliptic type equations with constant coefficients. Therefore, the whole algortihm is highly efficient. The energy stability and unique solvability are analytically proved. Numerical experiments validate the performance of the proposed method.

报告人简介

杨钧翔，于 2019 年 9 月获国家留学基金委资助在韩国高丽大学应用数学专业攻读博士学位，2021 年 8 月博士毕业，获理学博士学位。近三年参与发表 SCI 级论文 43 篇，其中以第一作者身份发表 SCI 级论文 28 篇。读博期间获韩国高丽大学全额奖学金，被中国驻韩大使馆教育处评为 2020 年度优秀在韩国家公派留学人员。目前于中山大学计算机学院数据科学研究所从事博士后研究，合作导师为谭志军教授。本人研究方向为相场模型，多组份流体模拟，科学计算等。

Deriving locally conservative fluxes from high-order finite element solutions by solving a constrained minimization problem

贡文波 中山大学

In this talk, the classical kth order, k ⩾ 1, Galerkin finite element solution for convection-diffusion equations is post-processed to derive the numerical fluxes which are conservative on a prescribed set of control volumes. The post-processing technique is realized through solving a constrained minimization problem where the constraints arise naturally from local conservation laws taking place on the control volumes, and the numerical flux is taken to be a polynomial of order k - 1 defined at each edge of control volumes. In contrast to the classic mixed method, the linear algebraic system derived from our minimization problem is symmetric. It is shown that the numerical flux converges to the exact one with optimal orders in a certain Sobolev spaces. Numerical experiments are conducted to confirm our theoretic findings. In particular, a simplified two-phase flow in highly heterogeneous porous media is simulated with our developed numerical flux.

个人简介

贡文波，中山大学计算机学院博士后。2020 年毕业于中山大学计算机学院，师从邹青松教授。主要研究方向为有限体积法、有限元解的后处理技术。

多孔介质中可压缩渗流驱动问题高效数值算法研究

胡汉章 嘉应学院

非线性抛物型系统描述为多孔介质中可压缩的渗流驱动问题，用具有特征混合有限元方法离散浓度方程，用抛物型混合有限元方法离散压力方程。采用两层网格算法对非线性耦合系统进行线性化。进一行，对压力、达西速度和浓度变量给出了 L^q 模误差估计，并在此基础上证明了两层网格解的 L^q 模误差收敛的。通过理论分析和数值实验，证明了两网格算法的有效性。

报告人简介

胡汉章嘉应学院副教授，2017 年 6 月博士毕业于华南师范大学。主持广省自然科学基金 1 项(2018.5.1-2021.4.30)。2018 年获得广东省教育厅“高校青年优秀科研人才国际培养计划”资助，于 2019 年 9 月至 2020 年 8 月在香港中文大学做访问学者，合作导师：邹军教授。目前主要研究油藏中的渗流驱动问题和 Schrödinger 方程等的高效数值算法方面。在 *J. Comput. Appl. Math.*、*Adv. Comput. Math.*、*Numer. Methods Partial Differential Equations*、*Numer. Linear Algebra Appl.*、*Commun. Comput. Phys.*、*Comput. Math. Appl.*、*Journal of Computational Mathematics* 和 *Numerical Algorithms* 等国际权威的 SCI 期刊上发表（中科院大类 2 区）论文十余篇。

Orientation Determination of Cryo-EM Images

潘欢 深圳大学

One of the main challenges in single particle reconstruction process from cryo-EM is to determine the orientation of each cryo-EM images. Orientation estimation is based on common lines methods. However, there exists two major difficulties in the orientations estimation of the cryo-EM images. First, the high level of noise in the cryo-EM images is not good for the detection of common lines between the cryo-EM images, and then affects the orientation estimation of the images. Second, we use the rotation matrix to represent the orientation of the image, and the the rotation matrix satisfies the orthogonality, so the non-convexity of the orthogonal constraint brings numerical calculations difficulties. In this paper we apply the generalized projection gradient descent method and the manifold proximal gradient method to solve the corresponding optimization problem based on orthogonal constraints and analyze the convergence of the algorithm. Due to the non-convexity of the constraint, we can only obtain local approximate solutions, but the numerical experiments still show the effectiveness of the proposed algorithm, and the running time of the algorithm is significantly reduced compared with the existing algorithms.

报告人简介

潘欢，目前在深圳大学读博士后，2021 年毕业于湖南师范大学，获数学理学博士学位。主要研究方向为数值优化算法与理论，冷冻电镜单颗粒三维重构，图像处理等。相关成果发表在国际期刊 Journal of Scientific Computing 和 Applied Mathematical Modelling 上。读博期间曾访问香港浸会大学深圳研究所和香港中文大学。主持完成湖南省研究生科研创新项目重点项目一项，获 2019 年博士研究生国家奖学金。