2018 年最优化理论与应用研讨会

程

序

册

武汉大学数学与统计学院

湖北 武汉

2018.04.11-2018.04.13

目录

2018 年最优化理论与应用研讨会

（2018 年 4 月 11 日-13 日，武汉）

一、会议宗旨

为了加强最优化理论与算法及其应用研究者之间的交流和相互联系，总结各地学者的最新理论、算法和应用研究成果，了解最优化理论与算法的国际发展动态和研究热点，以进一步推动和促进最优化理论研究和应用实践的迅速发展，中国运筹学会数学规划分会和武汉大学数学与统计学院拟于 2018 年 4 月 11 至 13 日在湖北武汉举办 2018 年最优化理论与应用研讨会。

二、会议主题

最优化前沿理论与算法及其应用，内容包括：线性与非线性规划、全局优化、变分不等式与互补、组合优化、双层优化、金融优化、管理科学与工程及其他领域中的优化问题与方法。

三、程序委员会

主　任：戴彧虹　(中科院数学与系统科学研究院)
　　　　修乃华　(北京交通大学)
委　员：白延琴　(上海大学)
　　　　陈光亭　(台州学院/杭州电子科技大学)
　　　　陈小君　(香港理工大学)
　　　　邢文训　(清华大学)
　　　　徐大川　(北京工业大学)
　　　　张立卫　(大连理工大学)

四、组织委员会

主　任：万仲平　(武汉大学)
　　　　徐大川　(北京工业大学)
委　员：陈旭瑾　(中科院数学与系统科学研究院)
　　　　胡　捷　(武汉大学)
　　　　黄正海　(天津大学)
　　　　李董辉　（华南师范大学）
　　　　吕一兵　（长江大学）
　　　　张玉忠　（曲阜师范大学）

五、会议安排与注意事项

1. 时间
   报名注册：2018 年 3 月 20 日
   报　　到：2018 年 4 月 11 日
   学术报告：2018 年 4 月 12~13 日
   代表离会：2018 年 4 月 13 日

2. 会议地址与交通
    1) 会议地点：湖北省武汉市武汉大学数学与统计数学东北楼报告厅 110
    2) 报到、住宿地点：君宜王朝大饭店

         地址：武汉市武昌区珞瑜路 87 号 武汉地铁 2 号线街道口站 C 出口群光广场对面
    交　通：
        (1) 飞机：武汉天河机场——机场大巴（付家坡长途汽车站，转乘公交车至广埠屯过马路）或出租车（120 元左右）
        (2) 高铁或动车：武汉火车站——地铁 4 号线至中南转乘 2 号地铁至广埠屯 K 出口出）；或出租车（约 50 元左右）
        (3) 高铁或动车:汉口火车站——地铁 2 号线至广埠屯 K 出口出；
        (4) 高铁或动车：武昌火车站——地铁 4 号线至中南转乘 2 号地铁至广埠屯 K 出口出；或出租车（约 30 元左右）

3. 注册与住宿
本次会议不收取注册费，统一安排住宿酒店，交通费与食宿费由参会代表自理。请参会人员于 2018 年 3 月 20 日前报名注册。

4. 联系方式
通讯地址：湖北省武汉市珞珈山武汉大学数学与统计学院，430072
会务组人员：邓琼，彭振华，律金曼，卢蒙卡，曾静，宋志国，马继佳，彭泽宇

由于住宿条件限制，所有参会人员请务必于 2018 年 3 月 20 日前将回执发
Email: hujie@amss.ac.cn, hujie_math@whu.edu.cn（胡捷）
mathwanzhp@whu.edu.cn(万仲平)，zhenhuapeng@whu.edu.cn（彭振华）
optimization_china@126.com (数学规划分会秘书处)
电话：18771069060(胡捷)
15071177105 或 15327386140（万仲平）15927566928（彭振华）
过此日期后，组委会将不再保证安排食宿及学术活动等。

武汉大学数学与统计学院
中国运筹学会数学规划分会

会议日程

	4 月 11 日	
8:00-21:00	会议报到注册	
12:00	中餐	
18:30	晚餐	
	4 月 12 日	
8:30-9:00	开幕式	主持人：万仲平 地　点：东北楼 110
	会议邀请报告 S1	主持人：徐大川 地　点：东北楼 110
9:00-9:30	稀疏优化中的若干新结果 修乃华（北京交通大学）	
9:30-10:00	Improved approximation for connected densest k-subgraphs 陈旭瑾（中国科学院）	
10:00-10:20	合影	
10:20-10:30	休息	
	会议邀请报告 S2	主持人：修乃华 地　点：东北楼 110
10:30-11:00	Symmetric Alternating Direction Methods of Multipliers for Optimization Problems 韩德仁（北京航空航天大学）	

11:00-11:30	主从博弈模型及其连续优化算法 林贵华（上海大学）
11:30-12:00	On the non-ergodic convergence rate of an inexact augmented Lagrangian framework for composite convex programming 刘亚锋（中国科学院）
12:00-14:00	午餐、午休

会议邀请报告 S3	主持人：李董辉 地　点：东北楼110

14:00-14:30	Relationships between the oriented distance functional and a nonlinear separation functional and applications 李声杰（重庆大学）
14:30-15:00	Well solvability of linear and convex optimization problems 郑喜印（云南大学）
15:00-15:30	目标罚函数的精确性与算法 孟志青（浙江工业大学）
15:30-16:00	Optimality conditions for set optimization problems via generalized derivatives 余国林（北方民族大学）
16:00-16:20	休息

	会议邀请报告 S4	主持人：陈小君 地　点：东北楼 110
16:20-16:50	On progressive hedging algorithm for multistage stochastic programming and stochastic variational inequalities 杨俊锋（南京大学）	
16:50-17:20	A Parallelizable Algorithm for Orthogonally Constrained Optimization Problems 刘歆（中国科学院）	
17:20-17:50	A Relaxation Approximation Method for　Regularized Mathematical Programs with Equilibrium Constraints 郭磊（上海交通大学）	
18:30	晚餐	
4 月 13 日		
	会议邀请报告 S5	主持人：张立卫 地　点：东北楼 110
8:30-8:55	两阶段随机变分不等式的并行算法 陈小君（香港理工大学）	
8:55-9:20	Optimality conditions and duality for robust nonsmooth multiobjective optimization problems with cone constraints 陈加伟（西南大学）	
9:20-9:30	休息	

	会议邀请报告 S6	主持人：邢文训 地　点：东北楼110
9:30-9:55	Optimal linearized symmetric ADMM for multi-block separable convex programming 常小凯（西安电子科技大学）	
9:55-10:20	双层规划问题的某些机理分析及应用 彭振华（武汉大学）	
10:20-10:30	休息	
	会议邀请报告 S7	主持人：黄正海 地　点：东北楼110
10:30-10:55	A Family of Two-point Stepsize Gradient Methods 戴彧虹（中国科学院）	
10:55-11:20	Robust submodular maximization over sliding window 徐大川（北京工业大学）	
11:20-11:45	On the Q-linear Convergence of a Majorized Proximal ADMM for Convex Composite Programming and Its Applications to Regularized Logistic Regression 张立卫（大连理工大学）	
11:45-14:00	午餐、午休	

	会议邀请报告 S8	主持人：徐义红 地　点：东北楼110
14:00-14:25	M-张量方程组的一个单调算法 李董辉（华南师范大学）	
14:25-14:50	Robust Sensitive Analysis for Linear Programming 邢文训（清华大学）	
14:50-15:15	Stationary probability vectors of higher-order two-dimensional transition probability tensors 黄正海（天津大学）	
15:15-15:40	分数阶投影动力系统解集刻画 黄南京（四川大学）	
15:40-15:50	休息	
15:50-18:00	自由讨论：最优化理论与应用发展趋势	
18:30	晚餐	

学术报告

稀疏优化中的若干新结果

修乃华 教授
北京交通大学

摘要： 稀疏优化是最优化学科中一个新的研究方向。它源于（受刺激）著名华裔数学家、2006 年菲尔兹奖得主陶哲轩和 Candes、美国科学院院士 Donoho 独立提出的压缩感知理论，在机器学习与人工智能、信号与图像处理、模式识别、生物信息学、统计推断、金融风险管理等领域中扮演着核心数学模型的角色。然而，稀疏优化属于非凸非连续优化问题，当然是一个 NP 难问题，传统的优化理论和算法面临极大挑战。因此，开展稀疏优化问题的理论和算法研究十分必要。本报告将介绍我校优化团队在这个方面的一些最新研究成果，以及未来研究设想。

Improved approximation for connected densest k-subgraphs

陈旭瑾 教授

中科院数学与系统科学研究院

摘要：Given an edge-weighted connected graph G on n vertices and an integer $k\le n$, a subgraph of G is called a k-subgraph if it contains exactly k vertices. The (weighted) density of a subgraph is the average (weighted) degree of all vertices of this subgraph. We study the problem of finding a connected k-subgraph of G with the maximum weighted density. We propose a combinatorial polynomial-time algorithm for the problem which achieves an approximation ratio of $O(n/k)$. The weighted density of the k-subgraph in G found by the algorithm is at least a factor $\Omega(k/n)$ of the maximum weighted density among all subgraphs in G with at least k vertices (which are not necessarily connected). The result improves upon the previously known best approximation ratio $O(n^2/k^2)$ for the problem, and matches the current best approximation ratio $O(n/k)$, in terms of n and k, for finding a k-subgraph with the maximum density. The $O(n/k)$-approximation algorithm combined with the previous $O(k)$-approximation algorithm of Chen et al. [Information and Computation 2017] finds a connected k-subgraph in G whose weighted density is at least a factor $\Omega(1/\sqrt n)$ of the maximum weighted density among all k-subgraphs. This is the best possible one can derive since the ratio of the maximum weighted density of a k-subgraph in G to that of a connected k-subgraph in G can be as large as $\Omega(\sqrt n)$.

(Joint work with Changjun Wang.)

Symmetric Alternating Direction Methods of Multipliers for Optimization Problems

韩德仁 教授

北京航空航天大学

摘要： The classic alternating direction method of multipliers (ADMM) for large scale separable optimization problems, as an application of the Douglas-Rachford splitting method, has exhibited its efficiency in various fields. As a counterpart, the symmetric alternating direction method of multipliers, an application of the Peaceman-Rachford splitting method, attracts more and more attentions, but its convergence is not well understood. In this talk, we present its convergence for some special models. We also give a modified symmetric alternating direction method of multipliers for multi-block case.

主从博弈模型及其连续优化算法

林贵华 教授

上海大学

摘要：经济与管理领域存在着形形色色的主从博弈现象。然而，即使最简单的线性主从博弈模型也已被证明是 NP 难的，因此关于主从博弈的算法研究极具挑战性。本报告将着重介绍主从博弈模型在连续优化算法方面的一些新进展，主要包括基于下层最优性条件的算法和基于下层最优值函数的算法等。此外，还将介绍一些相关的随机模型及算法进展。

On the non-ergodic convergence rate of an inexact augmented Lagrangian framework for composite convex programming

刘亚锋 助理研究员

中国科学院数学与系统科学研究院

摘 要： In this paper, we consider the linearly constrained composite convex optimization problem, whose objective is a sum of a smooth function and a possibly nonsmooth function. We propose an inexact augmented Lagrangian (IAL) framework for solving the problem. The stopping criterion used in solving the augmented Lagrangian (AL) subproblem in the proposed IAL framework is weaker and potentially much easier to check than the one used in most of the existing IAL frameworks/methods. We analyze the global convergence and the non-ergodic convergence rate of the proposed IAL framework. Preliminary numerical results are presented to show the efficiency of the proposed IAL framework and the importance of the non-ergodic convergence and convergence rate analysis.

Relationships between the oriented distance functional and a nonlinear separation functional and applications

李声杰 教授

重庆大学

摘要： In this paper, we study two nonlinear scalarization functionals, namely, the oriented distance functional and the nonlinear separation functional due to Tammer. First, we prove the monotonicity of the oriented distance functional when the associated set is neither cone nor convex. Then, we show several relationships between the two nonlinear scalarization functionals. By using these results, we obtain an estimation of the sublevel set of the oriented distance functional. Finally, we apply previous conclusions to investigate the properties of solutions for vector optimization problems and generalized Ky Fan inequalities, respectively.

Well solvability of linear and convex optimization problems

郑喜印 教授

云南大学

摘要：In terms of the well-known slices in geometry theory of Banach space, we introduce and consider bounded slice property for closed convex sets. With the help of this new notion, we study linear and convex optimization problems with a given convex constrained set A. In particular, under some mild assumptions, we characterize a closed convex set A such that all linear and convex optimization problems on A admit well-posed solvability and weak well-posed solvability.

目标罚函数的精确性与算法

孟志青 教授

浙江工业大学

摘要：介绍约束优化问题的几种非线性目标罚函数理论与算法的研究成果， 其中包括目标罚函数最优性、精确性、光滑化与算法分析等结果，给出一些算法的算例结果。

Optimality conditions for set optimization problems via generalized derivatives

余国林 教授

北方民族大学

摘要：A set-valued optimization problem in the sense of set order is often called set optimization problem. Although set optimization seems to be more natural and interesting than the vectorial one, the study on its optimality conditions in terms of generalized derivatives is very limited. In this talk, we focus on the optimality conditions of set optimization problems in terms of Mordukhovich's coderivatives and subdifferentials. Firstly, we briefly introduce some existed results related to optimality conditions by using some generalized derivatives of a set-valued mapping, such as, directional derivatives given by selected functions, directional derivatives defined by set differences, radial derivatives, and so forth. Then, we calculate the subdifferential of Tammer's nonlinear scalarization function. Finally, based upon the full rules of Mordukhovich's coderivatives and subdifferentials, we examine the necessary conditions for set optimization.

On progressive hedging algorithm for multistage stochastic programming and stochastic variational inequalities

杨俊锋 教授

南京大学

摘要：Progressive hedging algorithm (PHA) was originally proposed by Rockafellar and Wets in 1991 for stochastic convex optimization. Recently, it was extended to solving stochastic variational inequality problems by Rockafellar and Sun. It is known that PHA is an application of the proximal point algorithm. In this talk,we establish its connections with the alternating direction method of multipliers and Douglas-Rachford operator splitting method. These results sharpen our understanding to PHA and enable us to consider some extensions.

This is a joint work with Xiaojun Chen and Defeng Sun

A Parallelizable Algorithm for Orthogonally Constrained Optimization Problems

刘歆 副研究员

中国科学院数学与系统科学研究院

摘 要： To construct a parallel approach for solving orthogonally constrained optimization problems is usually regarded as an extremely difficult mission, due to the low scalability of orthogonalization procedure. In this talk, we propose an infeasible algorithm for solving optimization problems with orthogonality constraints, in which orthogonalization is no longer needed at each iteration, and hence the algorithm can be parallelized. We also establish a global subsequence convergence and a worst-case complexity for our proposed algorithm. Numerical experiments illustrate that the new algorithm attains a good performance and a high scalability in solving discretized Kohn-Sham total energy minimization problems.

A Relaxation Approximation Method for l_p Regularized Mathematical Programs with Equilibrium Constraints

郭磊 副研究员

上海交通大学

摘 要： We consider an $l_p(0 < p < 1)$ regularized mathematical programs with equilibrium constraints (MPEC). The sparse solution selection from the solution set of convex programs and the second-order road pricing problem in transportation science can be modelled as this kind of problems. Due to the non-Lipschitzness of the l_p regularization function, constraint qualifications for locally Lipschitz MPECs are no longer sufficient for Karush-Kuhn-Tucker (KKT) conditions to hold at a local minimizer. We first propose some qualification conditions and show that they are sufficient for KKT conditions to be necessary for optimality. Then we present a relaxed approximation method for solving this kind of problems where all the subproblems are more favorable compared with the original problem in the sense that the objective function is locally Lipschitz even smooth and the constraints typically satisfy certain constraint qualification. In our method, all the subproblems are solved until a weak approximate stationarity condition is satisfied. Due to the possible nonsmoothness of the objective function of the relaxed approximation subproblem, we also develop second-order necessary optimality for relaxed approximation subproblem. We show that any accumulation point of the sequence generated by our method is Clarke stationary if MPEC linear independence condition holds; it is Mordukhovich stationary if, in addition, an approaching subsequence satisfies an approximate weak second-order necessary condition; it is strongly stationary if, in addition, an upper level strict complementarity condition holds.

两阶段随机变分不等式的并行算法

陈小君 教授

香港理工大学

摘要： 两阶段随机变分不等式在工程与经济学领域中有著广泛的应用。有关两阶段随机变分不等式的理论、算法和应用在最近几年间被广泛的研究。 本报告将考虑两阶段随机线性变分不等式新的理论和有效的 Progressive Hedging 并行算法。

Optimality conditions and duality for robust nonsmooth multiobjective optimization problems with cone constraints

陈加伟 副教授

西南大学

摘要： In this paper, we investigate a robust nonsmooth multiobjective optimization problem related to a multiobjective optimization with data uncertainty. We firstly introduce a generalized robust constraint qualification and two kinds of generalized convex functions which are not necessary to be convex. Robust necessary optimality conditions for weakly robust efficient solutions and properly robust efficient solutions of the problem are established by a generalized alternative theorem and the robust constraint qualification. Further, robust sufficient optimality conditions for weakly robust efficient solutions and properly robust efficient solutions of the problem are also derived. The Mond-Weir type dual problem and Wolfe type dual problem are formulated. Finally, we obtain the weak, strong and converse robust duality results between the primal one and its dual problems under the generalized convexity assumptions.

Optimal linearized symmetric ADMM for multi-block separable convex programming

常小凯 讲师

西安电子科技大学

摘要：Due to its wide applications and simple implementations, the Alternating Direction Method of Multipliers (ADMM) has been extensively investigated by researchers from different areas. In this report, we focus on a linearized symmetric ADMM (LSADMM) for solving the multiblock separable convex minimization model. This LSADMM partitions the data into two group variables and updates the Lagrange multiplier twice in different forms and with suitable stepsizes, where two grouped variables are updated in a Gauss-Seidel scheme while variables within each group are updated in a Jacobi scheme. For the second group variables, however, linearized and relaxation techniques are used to deal with the quadratic term of subproblems and to accelerate the algorithm, respectively. We show the global convergence and the sublinear ergodic convergence rate of LSADMM. Theoretically, we obtain the optimal lower bound of the proximal parameter.

双层规划问题的某些机理分析及应用

彭振华 博士生

武汉大学

摘要：目前，求解双层规划问题的一般方法有下层最优值函数技术和 KKT 转化策略。当下层凸且满足 Slater 约束规格时，可用下层问题的 KKT 条件代替下层问题将其转化为一 MPECs\MPCCs 问题。本报告根据双层规划问题的应用背景及相关理论，探讨了双层规划问题的某些机理分析。设计双层规划问题的求解算法是 NP-难的，但是在实际应用问题中往往无需得到问题的精确最优解，只需要寻求使得上、下层决策者双赢的满意解。介绍求解双层规划问题的满意解的几种（直觉）模糊交互式方法。

A Family of Two-point Stepsize Gradient Methods

戴彧虹 教授

中国科学院数学与系统科学研究院

摘要： We propose a family of two-point stepsize gradient methods, which is a convex combination of the short Barzilai-Borwein (BB) stepsize and the long BB stepsize. It is shown that each stepsize in the family solves a least squares problem and hence possesses certain quasi-Newton property. The family also include some other stepsizes as its special cases. We prove that the family of methods is R-superlinearly convergent for 2-dimensional strictly convex quadratics. Moreover, the family is R-linearly convergent for the n-dimensional case. Numerical results are presented, which demonstrate that the proposed family is promising.

This is a joint work with Dr. Yakui Huang.

Robust submodular maximization over sliding window

徐大川 教授

北京工业大学

摘要： Maximizing the submodular monotone functions subject to cardinality constraint k is a classical problem in the fields of data mining and machine learning. In this paper, we first study this problem in a streaming fashion by combining two additional twists of sliding window and robust concept, which is named as the robust submodular maximization over sliding window (RSMOSW). For this problem, we are asked to find a solution only from the last W items, from which some elements may be removed. In this context, we provide a $0.0745-\epsilon$ approximation algorithm for any $\epsilon>0$. In addition, the memory space and the update-time per element of our algorithm both are proved to be bounded by $O(poly(k,\tau,\log k\Phi))$, in which τ is the robust parameter, meaning that at most τ elements may be removed, and Φ is the ratio between maximum and minimum values of singleton elements (Joint work with Ruiqi Yang, Yukun Cheng, and Dongmei Zhang).

On the Q-linear Convergence of a Majorized Proximal ADMM for Convex Composite Programming and Its Applications to Regularized Logistic Regression

张立卫 教授
大连理工大学

摘要： This paper aims to study the convergence rate of a majorized alternating direction method of multiplier with indefinite proximal terms (iPADMM) for solving linearly constrained convex composite optimization problems. We establish the Q-linear rate convergence theorem for 2-block majorized iPADMM under mild conditions. Based on this result, the convergence rate analysis of symmetric Gaussian-Seidel based majorized ADMM, which is designed for solving multi-block composite convex optimization problems, are given. We apply the majorized iPADMM to solve three types of regularized logistic regression problems: constrained regression, fused lasso and overlapping group lasso. The efficiency of majorized iPADMM are demonstrated on both simulation experiments and real data sets.

M-张量方程组的一个单调算法
李董辉 教授
华南师范大学

摘要：We are concerned with the numerical methods for solving the tensor equations with a strong M-tensor, which we call the M-tensor equations (M-TEQ). We first split the M-tensor into two parts. Based on the tensor splitting form, we propose an iterative method for solving the M-TEQ. The method can be regarded as an approximation to Newton's method for solving the M-TEQ. At each iteration, equation, we solve a system of linear equation. An advantage of the proposed method is that the coefficient matrix of the linear system is independent of the iteration. We show that if the initial point is appropriately chosen, then the sequence of iterates generated by the method convergs to a nonnegative solution of the M-TEQ monotonically. At last, we do numerical experiments to test the proposed methods. The results show the efficiency of the proposed methods.

Robust Sensitive Analysis for Linear Programming
邢文训 教授
清华大学

摘要：In this talk, robust sensitive analysis is considered with two scenarios for the linear programming problem. One is to sensitively analyze the maximum perturbation radius for different settings of the perturbation parameters of the constraints to keep a pre-decision robustly optimal. The other is to do sensitive analysis for the maximum perturbation radius of the perturbation parameters in constraints to have a robustly optimal solution which keeps some features of a pre-decision. Nonlinear programming formulations are provided to solve these problems and then are equivalently formulated into linear conic programs over second-order cones which are polynomially computable.

Stationary probability vectors of higher-order two-dimensional transition probability tensors

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天津大学

摘要：In this talk, we investigate stationary probability vectors of higher-order two-dimensional symmetric transition probability tensors. We show that there are two special symmetric transition probability tensors of order m dimension 2, which have and only have two stationary probability vectors; and any other symmetric transition probability tensor of order m dimension 2 has a unique stationary probability vector. As a byproduct, we obtain that any symmetric transition probability tensor of order m dimension 2 has a unique positive stationary probability vector; and that any symmetric irreducible transition probability tensor of order m dimension 2 has a unique stationary probability vector.
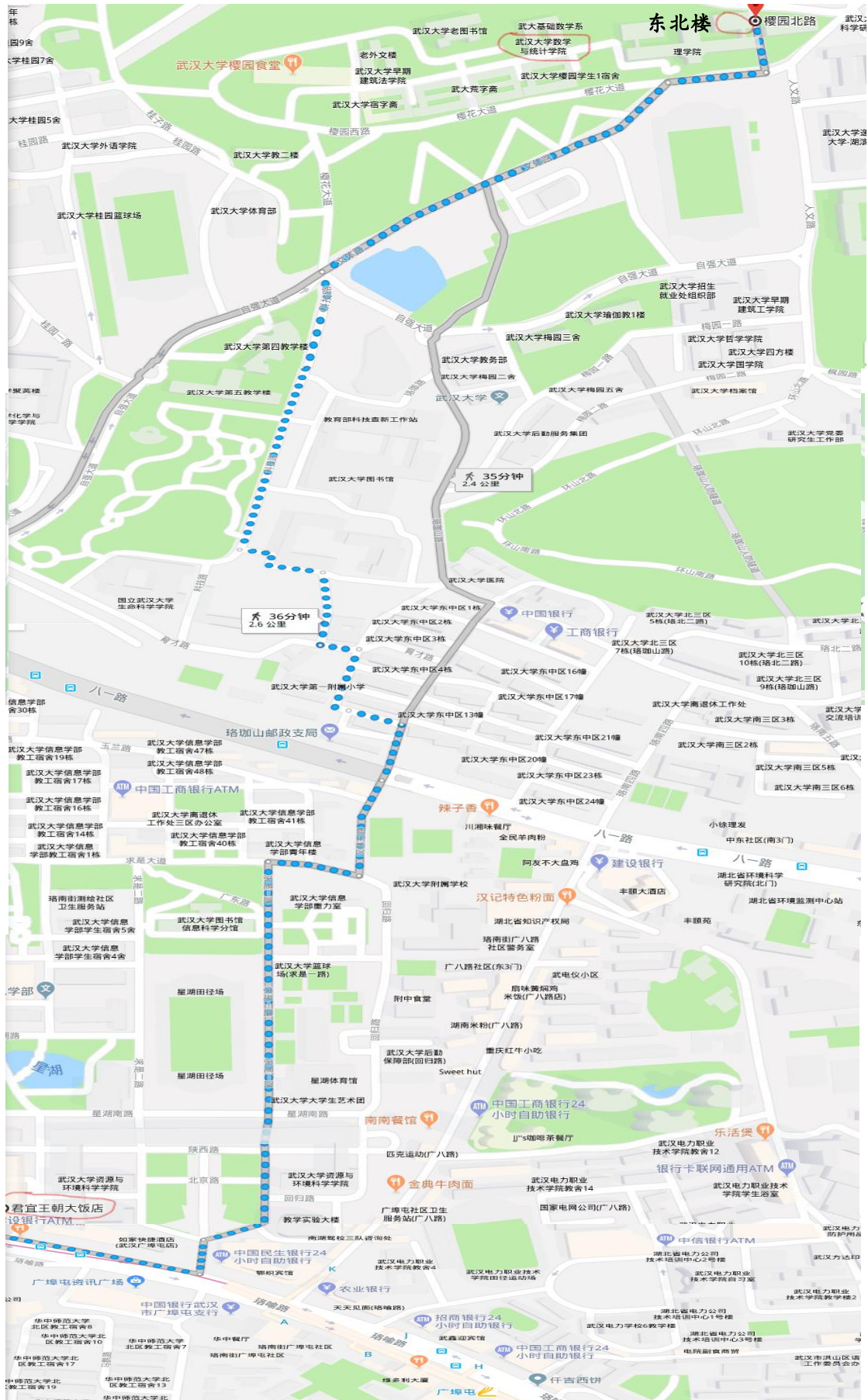
分数阶投影动力系统解集刻画

黄南京 教授

四川大学

摘要：报告涉及一些分数阶投影动力系统解集的刻画结果，获得了这些分数阶投影动力系统解集非空或者稳定的一些充分性条件，并给出了一些逼近算法和数值例子。报告内容基于与吴增宝、邹云志和闵超等人合作工作。

君宜王朝大饭店至数学与统计学院东北楼

东北楼

35分钟
2.4 公里

36分钟
2.6 公里

武汉大学地图