“最优化理论与应用研讨班”通知

为了提高我国最优化理论与应用研究水平，清华大学方述诚讲席教授组和北京交通大学应用数学系将于 2006 年 7 月 9－11 日在清华大学举办 “最优化理论与应用研讨班”。本研讨班特别邀请国内外知名学者就数学规划的最新发展与应用等专题进行讲授和讨论。

组织单位

清华大学数学科学系、北京交通大学应用数学系

倡导与组织人员

方述诚 教授（清华大学，North Carolina State University），叶荫宇 教授（清华大学，Stanford University），邢文训 教授（清华大学数学科学系），修乃华 教授 （北京交通大学）。

资助单位

清华大学教育基金会方述诚讲席教授基金、国家自然科学基金委“两个基地”基金、北京交通大学。

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报到地点：清华大学理科楼数学科学系一楼大厅

邀请报告专题

序号	时　间	主　讲	题　　目
专题 1	7 月 9 日 9:30-12:30	Zhiquan Luo	Recent optimization applications in information engineering
专题 2	7 月 9 日 13:30-15:00	Defeng Sun	Recent developments in nonlinear optimization theory
专题 3	7 月 9 日 15:30-17:00	Jinfeng Yue	Distribution free optimization procedures with business applications
专题 4	7 月 10 日 9:00-12:00	Shuzhong Zhang	Recent developments in conic optimization and its applications to discrete optimization
专题 5	7 月 10 日 13:00-14:30	Yaxiang Yuan	Recent developments in nonlinear optimization methods
专题 6	7 月 10 日 15:00-16:30	Bintong Chen	Optimal contract design for supply chain management
专题 7	7 月 11 日 9:00-12:00	Yinyu Ye	Recent optimization applications in sensor network and game theory
专题 8	7 月 11 日 13:00-14:30	Jiawei Zhang	Recent optimization applications in operations management
专题 9	7 月 11 日 15:00-16:30	Yu Xia	Optimization in supply chain management

注意事项：

1、 议程安排：7 月 9 日上午 9：00-9：30 为简单开幕式及照相，随后开始专题报告。
2、 本研讨班的工作用语为中文。为鼓励学术讨论，每天上午 10：00-10：30，下午 14：30-15：00 为讨论时间。
3、 研讨班免收会务费，并为全体参加人员提供免费工作午餐。
4、 本研讨班得到清华大学教育基金会方述诚讲席教授组和北京交通大学国家自然科学基金委“两个基地”基金的部分资金支持，将对参加研讨班的北京地区以外的青年学者或研究生给以部分住宿和伙食补贴（限 40 人）。请有意得到资助者于 2006 年 6 月 15 日前将回执（最好用 email)发回，回执中导师的电话和 email 地址必须填写，以确保不浪费我们的预定资源。我们将于 6 月 21 日通过 email 通知获得资助的信息。
5、 其他不需要资助但需要解决住宿的北京地区以外成员请在回执中标明住宿的需求，于 2006 年 6 月 15 日前将回执发回，我们尽量安排校内住宿，并将于 2006 年 6 月 21 日通知预定情况。由于届时校内宾馆床位紧张，我们无法保证能定到床位。请尽早与联系人联系并保证能按期到达。
6、 北京地区参加人员请于 2006 年 6 月 21 日前用 email 向联系人报名，以便统计人数，安排工作餐。
7、 2006 年 7 月 8 日 9：00-18：00 在清华大学数学科学系（理科楼大厅）接待预约安排住宿的研讨班成员。
8、 请尽量采用电子邮件的方式同我们联系。

回执

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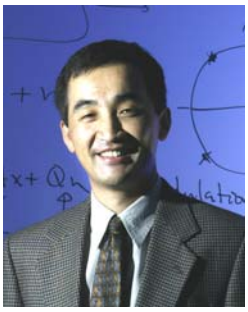
报告人及报告内容简介



Zhiquan Luo (罗智泉) is a professor with the Department of Electrical and Computer Engineering and holds an endowed ADC research Chair in Digital Technology, Minnesota University. He received a B.Sc. degree in Mathematics from Peking University, China, in 1984 and received a Ph.D. degree in Operations Research in 1989 in the Department of Electrical Engineering and Computer Science, Massachusetts Institute of Technology. His current research work is at the interface of optimization and information engineering, and he has published extensively in both areas. His general research interests lie in the union of large-scale optimization, information theory and coding, data communications and signal processing. Professor Luo is a member of SIAM and MPS. He is also a member of the Signal Processing for Communications (SPCOM) and Signal Processing Theory and Methods (SPTM) Technical Committees of the IEEE Signal Processing Society. From 2000 to 2004, he served as an Associate Editor for the *IEEE Transactions on Signal Processing* and *Mathematics of Computation*. He is presently serving as an associate editor for several international journals including *SIAM Journal on Optimization, Mathematical Programming*, and *Mathematics of Operations Research*. He received an *IEEE Signal Processing Society Best Paper Award* in 2004.

报告题目：**Recent optimization applications in information engineering**

In recent years there have been major advances in the algorithms and software for convex conic optimization. These research advances are beginning to find exciting applications in digital signal processing and communications, giving powerful new modeling and computational tools to solve previously considered intractable problems. This tutorial will use various engineering examples to illustrate some of the basic concepts and algorithms in convex conic optimization that are most useful in signal processing and communication. These include the interior point algorithms for linear programming, Second Order Cone programming and Semidefinite Programming (SDP), and complexity bounds. The emphasis of this presentation is on how to recognize and exploit convexity (sometimes hidden) in various engineering formulations, and introduce mathematical techniques for efficient solution or relaxation of nonconvex problems arising from communication system design. Theoretical foundation and general complexity analysis will be mentioned, but is not the primary focus. Various application examples will be considered, including interior point least squares algorithm, pulse shaping filter design, robust beamforming, channel equalization, transceiver design for multi-access communication and quasi-ML detection via SDP relaxation. The aim of this tutorial is to give attendees the background required to use modern convex optimization methods in their own optimization research or engineering work.

Defeng Sun (孙德锋) received his B.S. and M.S. degrees from Department of Mathematics, Nanjing University in 1989 and 1992, respectively and his Ph.D. degree in 1995 from Institute of Applied Mathematics, Chinese Academy of Sciences under the supervision of Professor Jiye Han (韩继业). He is currently an Associate Professor with tenure at Department of Mathematics, National University of Singapore (NUS). His research interests include perturbation theory, variational analysis, and smoothing Newton methods for optimization problems and beyond.

报告题目：**Recent developments in nonlinear optimization theory**

This lecture aims to give an overview of recent progress on second-order optimality conditions and stability results for nonlinear optimization problems with non-polyhedral convex cone constraints (perhaps it can be better coined as “nonlinear conic programming problems”). The non-polyhedral nature of these convex cones poses a great deal of difficulties in extending relevant results from conventional nonlinear programming (NLP), in which a special polyhedral convex cone -- the nonnegative orthant instead of a non-polyhedral cone is involved, to nonlinear conic programming. We explain Robinson’s constraint qualification and the no gap second-order necessary and sufficient conditions. In these conditions, an additional term (called the “sigma term”) which vanishes for conventional NLP is included. This additional term corresponds to the non-polyhedral nature of the convex cones and inevitably complicates our analysis in theory and rate of convergence of numerical algorithms. To better understand these problems, we focus on nonlinear semidefinite programming (SDP) problem in which the cone of symmetric and positive semidefinite matrices (SDP cone for short) is involved. We propose a strong second-order sufficient condition. Through this condition, we establish the equivalence of the strong second-order sufficient condition and constraint non-degeneracy, Clarke’s non-singularity, Robinson’s regularity, Kojima’s strong stability, and many other generalized derivative based characterizations of locally Lipschitz homeomorphisms at a local solution point. We show how these results can be used to prove convergence and rate of convergence of the augmented Lagrangian method for solving the nonlinear SDP problem. Variational analysis on the metric projector over the SDP cone plays a fundamental role in achieving these. Finally, we talk about the more general problems and list several unsolved challenging questions.

Jinfeng Yue (岳劲峰) graduated from Department of Geophysics, Peking University in 1983, and obtained a Ph.D. degree in 2000, Washington State University. He joined the Middle Tennessee State University faculty team in 2001 and was named Robert W. McLean Distinguished Assistant Professor in Jennings A. Jones College of Business in 2004. His associate professor has been proved at Department of Management and Marketing, Middle Tennessee State University in 2006. His research interests include supply chain management, distribution free robust decision, inventory management, quality management, and multi-criteria decision making methods.

报告题目：**Distribution free optimization procedures with business applications**

Distribution Free Optimization in two-way penalty functions is widely used in many business decisions such as inventory, airline yield management, job location and scheduling and quality control. A typical two-way penalty function contains a decision value and a random variable, with penalties if the random variable is different from the decision value. There are two major types of two-way penalty functions: linear and quadratic. Linear penalty function has been found in inventory models, airline yield management models, and some job location and scheduling models. The quadratic penalty function, however, has been seen in quality control models and some job location and scheduling models. Generally, the decision in the two-way penalty form always depends on the distribution information of the random variable. More distribution information available, better decision can be made. However, in many circumstances, the entire distribution information of the random variable is not available, and only limited information can be obtained. How to make a decision for the two-way penalty model with limited information? This is the question called distribution free optimization.

In this study, we discuss the history of distribution free optimization with business applications. With only mean and standard deviation available, optimization procedures for both the linear penalty form and the quadratic penalty form are discussed. For the linear penalty, we obtain the asymptotically tight lower bounds of the objective function for every given decision value. A tight range for the optimal decisions is derived in a closed form solution regardless of the distribution. It turns out that the robust solution derived from the range of optimal decisions is exactly the same as Scarf's rule. We also obtain the expected value of distribution information for any possible solution, and associated min-max regret value solution. For a quadratic penalty, the asymptotically tight upper and lower bounds of the objective function for every given decision are obtained in closed form solution as well. The tight range of optimal decisions is obtained and a robust result is derived from the range of optimal decisions. Performance evaluations are also provided.

For limited information of known mean, minimum, and maximum, we discuss the distribution free decision procedures for two-way penalty models. For a general penalty form, we find the most favorable distribution and the least favorable distribution, and therefore, determine the tight range for objective function. For nonlinear penalty form, we suggest to use the min-max approach. For linear penalty form, we find the tight optimal solution range. To obtain the solution in linear penalty form, we discuss several approaches. Among them, we suggest an approach which considers both tight optimal solution range and probabilities of optimal points. The procedure suggested can be regarded as an approximated robust solution for the linear penalty form with known mean, maximum, and minimum.

Shuzhong Zhang (张树中) graduated from Department of Mathematics, Fudan University in 1984, and obtained a Ph.D. degree in 1991 from Tinbergen Institute, Erasmus University, The Netherlands. He is currently a full professor at Department of Systems Engineering & Engineering Management, The Chinese University of Hong Kong. Prior to this position, he served as a faculty member at Department of Econometrics, University of Groningen (1991 – 1993), and at Econometric Institute, Erasmus University Rotterdam (1993 – 1999). He was a recipient of the SIAM Outstanding Paper prize in 2003. He is currently Associate Editor of Optimization and Engineering, SIAM Journal on Optimization, Pacific Journal of Optimization, and Operations Research. His research interests include conic optimization, robust optimization, randomization algorithms, and their applications in engineering, management, and economics.

报告题目：**Recent developments in conic optimization and its applications to discrete optimization**

In this lecture we shall discuss at a detailed level the applications of conic optimization and semidefinite programming (SDP) in the design of randomized algorithms for solving discrete optimization problems. Such problems arise from a great variety of applications, including graph theory, signal processing, portfolio selection, and so on. We shall discuss in particular the use of complex variables in this approach. The entire lecture will be divided into three parts. The first part includes a general introduction to: complex SDP, quadratic modeling, SDP relaxation, randomization algorithms, rounding procedures based on normal distributions. Then, in the second part we shall show how to apply these techniques to derive approximation bounds (or ratios) for quadratic models, using complex decision variables. In the third and last part of the lecture, we shall discuss applications of the randomization algorithms in portfolio selection. In particular, we consider the situation where there is a constraint on the cardinality of the assets being selected in the portfolio. Alternatively, the investor may decide to hold each asset either with a substantial amount or not at all, in order to increase the efficiency of the portfolio management. In both cases, the decision models, though practical and appealing, are exceedingly hard combinatorial problems that are notoriously difficult to solve to optimality. We shall showcase the power of relaxation and randomization through analyzing its effects on these particular applications.

Ya-xiang Yuan (袁亚湘) received the B.S. degree(1981) in Computational Mathematics from Xiangtan University, Hunan, China, and the Ph.D. degree(1986) in Applied Mathematics from Cambridge University, UK. He was a Rutherford Research Fellow of Fitzwilliam College, Cambridge from Oct 1985 to Sept 1988. He became a full professor at the Computing Centre of Chinese Academy of Sciences in Nov. 1988, the youngest full professor of the Chinese Academy of Sciences at that time. Currently he is a vice president of the Academy of Mathematics and Systems Science of CAS, and the director of Institute of Computational Mathematics and Scientific/Engineering Computing. His major researches are on numerical methods for nonlinear optimization, particularly on trust region algorithms, quasi-Newton methods, and conjugate gradient methods. His current research interests include null space techniques for nonlinear optimization, quadratic assignment problems, trust region interior point methods for nonlinear optimization and mixed least square problems.

报告题目：**Some Recent Advances in Numerical Methods for Nonlinear Optimization**

This lecture will discuss about some of the recent advances in numerical methods for nonlinear optimization. First, subspace techniques will be described. The subspace approach basically try to define the search direction (in a line search algorithm) or the trial step(in a trust region algorithm) in a subspace, which is modified from iteration to iteration. Such an approach would reduce the computational costs in each iteration, and can also use all the information accumulated in the previous iterations. Hence it may provide an efficient way for handling large scale problems. Another topic is about filter method, which was first invented by Fletcher and Leyffer recently. Filter method is essentially a globalization technique for convergence without using penalty functions. In this lecture we will discussion recent generalizations of the Filter method.

Bintong Chen（陈滨桐） graduated from Department of Ship-Building and Naval Architecture of Shanghai Jiao Tong University in 1985. He obtained his Ph.D. degree from Wharton School of University of Pennsylvania in 1990. Since then he has been working for the Department of Management and Operations of Washington State University as assistant, associate, and full professors. He was recently named the Pat and Ann Redmond Faculty Fellow by the College of Business. He is currently a Senior Editor for Production and Operations Management journal. His research interests include continuation methods for complementarity problems, optimization techniques, and their applications for business problems. More recently, he has been working with his students on optimization models for supply chain management.

报告题目：**Optimal contract design for supply chain management**

The talk will start by reviewing supply chain management literature, typical supply chain models, the benefit from supply chain coordination, and various contracts designed for supply chain coordination. It is pointed out that benefit from coordination varies depends on the type of supply chain. In particular, it is shown that the benefit from coordination can be as little as no more than 14% for certain type of commonly used supply chain models. Traditional supply chain literature often assumes that players in the supply chain attempts to maximize their (expected) profits. In reality, the actions taken by an organization are often geared towards achieving certain pre-set target. The talk will then discuss about supply chain coordination under this new objectives. In particular, conditions to achieve coordination as well as contracts the lead to the coordination are identified. Finally, the talk will discuss about the extensions of supply chain research where each players have multiple objectives: the coordination condition as well as contracts that lead to the coordination.

Yinyu Ye (叶荫宇) received the B.S. degree in System Engineering from the Huazhong University of Science and Technology, Wuhan, China, and the M.S. and Ph.D. degrees in Management Science & Engineering from Stanford University, Stanford. Currently, he is a tenured Professor of Management Science and Engineering and, by courtesy, Electrical Engineering and the Director of the MS&E Industrial Affiliates Program, Stanford University. His current research interests include complexity of Markov Decision Problem, Computational Game/Market Equilibrium, Metric Distance Geometry, Graph Realization, Stochastic Combinatorial Optimization, Dynamic Resource Allocation and Decision, etc.

报告题目：**Recent optimization applications in sensor network and game theory**

The first part of the lecture describes a semidefinite programming (SDP) based model and method for the position estimation problem in Euclidean distance geometry such as wireless sensor network localization. The optimization problem is set up so as to minimize the error in sensor positions to fit incomplete and noisy distance measures. We develop an SDP relaxation model and use the duality theory to derive necessary and/or sufficient conditions for whether a network is "localizable" or not, when the distance measures are accurate. We also present probabilistic analyses of the SDP solution when the distance measures are noisy. In all cases, observable gauges are developed to certify the quality of the position estimation of every sensor and to detect possible erroneous sensors. Furthermore, we develop regularization and gradient-based local search methods to round and improve the SDP solution. Computations will be demonstrated to show the effectiveness of the method.

Theoretically, we show that SDP can be used for realizing graphs in the 3-dimensional space. Specifically, we use SDP duality theory to show that given a graph G and a set of lengths on its edges, the optimal dual multipliers of a certain SDP give rise to a proper equilibrium stress for some realization of G. Using this result and other techniques, we then obtain an algorithm for realizing 3-realizable graphs. In particular, we show how to use SDP to pack unit-balls to achieve the largest kissing number in the 3-dimensional space.

On the second part of the lecture, we study the Arrow-Debreu exchange market problem with linear and Leontief's utilities. We show that the problem with linear utility is as easy as linear programming, but the one with Leontief’s utility is as hard as NP-hard. More specifically, a special class of the latter problem can be decomposed to solutions of two systems of linear equalities and inequalities, and the equilibrium vector is the Perron-Frobenius eigen-vector of a scaled Leontief utility matrix. Therefore, if all input data are rational, then there always exists a rational Arrow-Debreu equilibrium, that is, the entries of the equilibrium vector are rational numbers. Consequently, for the first time, we show that this class of Leontief's exchange market problems is equivalent to the bimatrix Nash game problem. Furthermore, we present a promising interior-point path-following algorithm for solving the problem with Leontief's utility and leave its convergence as an open problem.

Jiawei Zhang (张家伟) is an Assistant Professor of Operations Management at the Stern School of Business, New York University. He received his Ph.D. in Operations Research from Stanford University. His research interests include mathematical programming and its applications. Current projects involve semidefinite programming, stochastic programming, inventory centralization, supply chain network design, and scheduling. He won the INFORMS 2004 Optimization Prize for Young Researchers for his paper "Approximating the Two-Level Facility Location Problem via a Quasi-Greedy Approach", which is to appear in *Mathematical Programming*.

报告题目：**Recent Applications of Optimization in Operations Management**

Linear programming (LP) duality has played a fundamental role in the analysis of cooperative games. In this lecture, we will present novel applications of LP duality and stochastic LP duality in studying cooperative games in inventory management. In particular, we show that duality theory can be used to prove the non-emptiness of cores for such inventory games and to find an element in the core.

The first example is the economic lot-sizing game, in which multiple retailers form a coalition by placing joint orders to a single supplier in order to reduce ordering cost, which is assumed to be a concave function of the order quantity. We are concerned with the issue of how to allocate the cost/benefit so that it is advantageous for every retailer to join the coalition. The standard formulation of the corresponding optimization problem is a concave minimization problem, and hence LP duality does not directly apply. We suggest an integer programming formulation for this optimization problem and show that its LP relaxation admits zero integrality gap, which makes it possible to analyze the game by using LP duality. We show that there exists an optimal dual solution that defines an allocation in the core, which can be found in polynomial time. An interesting feature of our approach is that it is not necessarily true that every optimal dual solution gives a core allocation. This is in contrast to the duality approach for other known cooperative games.

Another example is a single-period inventory centralization game with stochastic demand where multiple retailers form a coalition by holding centralized inventory in order to take advantage of risk pooling. Again, we are concerned with the issue of how to allocate the cost/benefit. When the ordering cost is linear, the optimization problem corresponding to the inventory game is formulated as a stochastic program. We observe that the strong duality of stochastic LP not only directly leads to a series of recent results concerning the non-emptiness of the cores of such games, but also suggests a way to find an element in the core. We further construct a nontrivial infinite dimensional LP dual for the well-known newsvendor problem with concave ordering cost, and prove a strong duality result for this non-convex minimization problem. This new duality result immediately implies that the corresponding game has a non-empty core. Finally, we prove that it is NP-hard to determine whether a given allocation is in the core for the newsvendor game even in a very simple setting.

Yu Xia（夏雨）is an Assistant Professor of Department of Management and Marketing, Middle Tennessee State University. She received the Ph.D. in Operations Management at Washington State University, 2004, the M.S. in Statistics at Washington State University, 2003, the M.E. in Finance at Shanghai Jiaotong University, 1997 and the B.E. in Electronic Engineering at Huazhong University of Science & Technology, 1994.

报告题目：**Optimization in Supply Chain Management**

Supply chains are effective networks of independent /dependent firms performing from end-to-end disparate set of activities involved in a particular product/service value chain through market mechanisms, contracts and partnership arrangements. Supply Chain Management (SCM) practices offer companies new ways to increase their logistical efficiencies, quickly response to customer service, and reduce costs in their global facility and supply networks, and improve revenue and working capital usage. It is a current and hot topic in operations management.

Optimization through coordination, cooperation and competition throughout the channel is among the most important supply chain management issues as its implications are significant and long lasting. In retailing, Wal-Mart successfully manages its supply channel in term of information sharing, contract fulfilling and setting up of distribution canters and so on. As the result, the logistic / distribution cost of Wal-Mart is significant lower than that of many of its competitors, for example, K-Mart, which is currently being pushed to bankruptcy. For manufacturers, the competitive success of them used to be determined by the extent and depth of their own manufacturing capabilities. But now most of them rely on extensive outsourcing all over the world; and their success is determined by their ability to effectively create and coordinate global supply chains in a fast paced technology and short product life cycle, uncertain demand world. In general, the competition among business is no long competition of independent corporations, but competition among the supply channels, thus the effectiveness in supply chain management.

This presentation seeks to review several key directions, some most important literatures and results of supply chain optimization research. Several topics will be covered, including central control, decentralization, coordination and competition. Supply chain of different structures, for example, multi-stage supply chain, linear supply chain and divergent supply chain will be introduced. Some major results, including bullwhip effect, power-of-two policies, and lot-sizing coordination etc. will be focused. The presenter will also introduce some current research topics and her research results for discussion, consisting of competition and matching among suppliers, retailers, and buyers.