

INSTITUTE FOR MATHEMATICS AND ITS APPLICATIONS

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Newsletters, Updates and preprints are available via

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IMA NEWSLETTER # 312

September 1–September 30, 2002

2002–2003 Program

OPTIMIZATION

See <http://www.ima.umn.edu/optimization/> for a full description of the 2002–2003 program on Optimization.

IMA schedules are subject to revision, particularly during workshops. See <http://www.ima.umn.edu/~seminar/sched> and <http://www.ima.umn.edu/newsletters/> for the latest scheduling information.

PART I: NEWS AND NOTES

Delaware joins IMA as a Participating Institution

The University of Delaware, in Newark, Delaware, has joined the IMA as a Participating Institution. For information on the benefits of becoming a Participating Institution at the IMA, point to <http://www.ima.umn.edu/pidescription.html>. For more information about the University of Delaware math department, point to <http://www.math.udel.edu/>.

Doug Arnold gives Plenary Lecture at the ICM

On 24 August, the IMA Director, Doug Arnold, gave a plenary address to the 2002 International Congress of Mathematicians, in Beijing. His talk was titled, “From exact sequences to colliding black holes: Differential complexes in numerical analysis”.

IMA New Associate Director

Scot Adams will succeed Bob Gulliver as Associate Director of the IMA, beginning 1 September 2002. The position has a three-year term.

PARTICIPATING INSTITUTIONS: Centrum voor Wiskunde en Informatica (CWI), Consiglio Nazionale delle Ricerche, Georgia Institute of Technology, Indiana University, Iowa State University, Kent State University, Los Alamos National Laboratory, Michigan State University, Mississippi State University, Northern Illinois University, Ohio State University, Pennsylvania State University, Purdue University, Sandia National Laboratories, Seoul National University (BK21 Math-SNU), Seoul National University (SRCCS), Texas A&M University, University of Chicago, University of Cincinnati, University of Houston, University of Illinois (Urbana), University of Iowa, University of Kentucky, University of Maryland, University of Michigan, University of Minnesota, University of Notre Dame, University of Pittsburgh, University of Wisconsin, University of Wyoming, Wayne State University.

PARTICIPATING CORPORATIONS: Boeing, Ford, General Motors, Honeywell, IBM, Lockheed Martin, Lucent, Motorola, Schlumberger, Siemens, Telcordia Technologies, 3M.

Version of September 30, 2002

IMA Tutorial:

Supply Chain and Logistics Optimization

September 9–13, 2002

Organizers: Cynthia Barnhart (Civil and Environmental Engineering Department, MIT), Michael Juenger (Institut fuer Mathematik, Universitaet zu Koeln), and David Simchi-Levi (Engineering Systems, MIT)

See <http://www.ima.umn.edu/optimization/fall/t1.html>

IMA Workshop:

The Role of Optimization in Supply Chain Management

September 23-27, 2002

Organizers: Brenda Dietrich (Mathematical Sciences, IBM T.J. Watson Research Center), George Nemhauser (Georgia Institute of Technology), and David Simchi-Levi (Engineering Systems, Massachusetts Institute of Technology)

See <http://www.ima.umn.edu/optimization/fall/op1.html>

IMA “Hot Topics” Workshop:

Operational Modeling and Biodefense: Problems, Techniques, and Opportunities

September 28, 2002

Organizers: Douglas N. Arnold (Director, IMA), Mac Hyman (Los Alamos National Laboratory), Edward H. Kaplan (Management Sciences, Yale University)

Cosponsored with the Society for Industrial and Applied Mathematics (SIAM) and with additional support from the University of Minnesota Consortium on Law and Values in Health, Environment & the Life Sciences.

See <http://www.ima.umn.edu/optimization/fall/biodefense.html>

IMA 2002-03 PROGRAM: OPTIMIZATION

Mathematical Optimization is experiencing substantial advances. There have been remarkable developments in the underlying methods – for example: (*) the emergence of interior methods for both linear and nonlinear optimization problems, (*) the rediscovery of *cuts* as an effective tool for solving general integer programs, as well as for structured problems, and (*) the emergence of new disciplines

such as positive semidefinite programming which attack a broad variety of discrete and continuous problems. The problems being studied have grown rapidly and the computing platforms are increasing in power by orders of magnitude. This is an excellent time for the consolidation and advancement in this field as the focus of an IMA Special year.

The year is broken into three quarters, each focusing on a different topic. The fall quarter is almost complete and has focused on the rapidly evolving area of supply chain, transportation and logistics optimization, as well as advances in integer programming.

The winter quarter will focus on advances in the underlying methods dealing with both nonlinear and linear optimization. Specific focus areas will include semidefinite programming, computational differentiation and nonconvex optimization.

The spring quarter will deal with the connections between optimization and information technology, an area that is proving to be increasingly important, and which will substantially benefit from a period of focus. This includes areas of discrete mathematics as well as areas such as network design and optimization.

We plan to hold a one-week introductory workshop at the beginning of the year, for the particular benefit of the optimization year postdocs. This will provide an overview of the state of the art in the underlying mathematical disciplines, and should provide a basis for much of the years activities. In addition, we will hold shorter tutorial workshops as needed during the three semesters.

IMA Website

Comments or suggestions concerning the IMA website may be addressed to

webmaster@ima.umn.edu.

In particular, we appreciate any information about World-Wide Web links appropriate to current and upcoming IMA programs.

PART II: SCHEDULE FOR SEPTEMBER 1–SEPTEMBER 30, 2002

Monday, September 2

Labor Day, a University of Minnesota holiday. IMA offices will be closed.

Tuesday, September 3

The 10:30 IMA break will be in Lind Hall 400.

Wednesday, September 4

The 10:30 IMA break will be in Lind Hall 400.

Thursday, September 5

10:15 am

Orientation

Lind 400

For postdocs and visitors

Friday, September 6

The 10:30 IMA break will be in Lind Hall 400.

Monday, September 9

**IMA Tutorial:
Supply Chain and Logistics Optimization**

September 9–13, 2002

Organizers: Cynthia Barnhart (Civil and Environmental Engineering Department, MIT),
Michael Juenger (Institut fuer Mathematik, Universitaet zu Koeln), and David
Simchi-Levi (Engineering Systems, MIT)

See <http://www.ima.umn.edu/optimization/fall/t1.html>

From September 9-13, 2002, we will hold a five-day tutorial workshop as an introduction to the IMA thematic year on Optimization and, especially, the fall quarter on Supply Chain and Logistics Optimization. The tutorial will provide an overview of the state of the art in the underlying mathematical disciplines and their application to supply chain and logistics. Topics include linear programming, integer programming, stochastic optimization, combinatorial optimization, and supply chain optimization. Issues addressed include supply chain design, production, inventory and transportation coordination, pricing and yield management, and vehicle routing problems. Hands-on computing experience (using AMPL and ILOG) will be provided to illustrate these methodologies and modeling concepts. Several important applications will be explored, including vehicle routing and scheduling, dynamic pricing, and service parts logistics.

All talks start in Lecture Hall EE/CS 3-180 unless otherwise noted.

Note that the talks will be in “two” 45 minute intervals, separated by a 15 minute break.

8:30 am	Coffee and Registration	Reception Room EE/CS 3-176
9:15 am	Douglas N. Arnold, Scot Adams, and Organizers	Welcome and Introduction
9:30–11:15	Daniel Bienstock Columbia University	Large-Scale Linear Programming

Abstract: Linear Programming is the central tool of Mathematical Programming. Linear programming models are flexible enough to adequately describe many realistic problems arising in modern industrial settings, while at the same time taking advantage of the considerable expertise on computational linear algebra that has been developed during the last fifty years. As a result, linear programming models are abundantly used in logistics, transportation, finance and many other practical applications.

Linear Programming has undergone profound changes during the last twenty years, resulting in codes that are thousands (and sometimes, millions) of times faster than what was available just fifteen years ago. Yet difficult challenges persist, in the form of large-scale linear programming problems arising in routing, network design, chip design and other settings. In fact, large problem instances render even the best of codes nearly unusable.

In this lecture we will survey fundamentals of Linear Programming theory, with special emphasis on recent developments, and in particular, on techniques geared to handling very large instances.

10:15–10:30 **Coffee Break** EE/CS 3-176

2:30–4:15 **Robert Fourer** AMPL hands-on session
Northwestern University

Abstract: Modeling languages describe optimization problems to computer systems in the symbolic terms familiar to people, rather than in the obscure input forms convenient to optimizing algorithms. In typical use, a symbolic model and specific data are automatically translated to a problem instance and submitted a solver; subsequent results are automatically retrieved and translated back to forms convenient for inspection and analysis. A single modeling language can be interfaced to many solvers, providing access to techniques for a range of linear, nonlinear, and discrete problems, and encouraging comparisons between alternative algorithms for individual problem types.

This session will provide an introduction to AMPL, one of the more widely used optimization modeling languages, through a series of simple linear and integer programming models. Participants will have a chance to experiment with AMPL models and to ask how a modeling language might be applied to problems of special interest to them.

3:15–3:30 **Coffee Break** EE/CS 3-176

4:15 pm **IMA Tea/Reception** IMA East, 400 Lind Hall

A variety of appetizers and beverages will be served.

Tuesday, September 10

All talks start in Lecture Hall EE/CS 3-180 unless otherwise noted.

9:00 **Coffee** EE/CS 3-176

9:30–11:15 **John R. Birge** Stochastic Optimization
Northwestern University

Abstract: Supply chain and logistics problems inevitably involve the consideration of random quantities such as uncertain demands, supplies, travel times, costs and prices. This tutorial will present some fundamental stochastic optimization models to include such random events. The models will include decisions for network design, capacity, vehicle flows, and contract terms. We will then present a general framework for these stochastic optimization problems, their basic properties, algorithms, and solutions. The discussion will focus on discrete-time models but will also introduce continuous-time models and real-option approaches to deal with financial issues in supply chains and logistics.

10:15–10:30 **Coffee Break** EE/CS 3-176

2:30–4:15 **E. Andrew Boyd** Dynamic Pricing and Revenue Management
PROS Revenue Management

3:15–3:30 **Coffee Break** EE/CS 3-176

Wednesday, September 11

Abstract: ILOG is the world leader in optimization technology, supplying the world's most powerful and comprehensive components for developing optimization applications. With core algorithms from mathematical programming and constraint programming, the ILOG Optimization Suite is highly effective at solving industrial and research problems in constraint satisfaction and optimization. The ILOG Optimization Suite powers the leading software for supply chain management and logistics optimization.

In this tutorial, we will use a rapid development system to explore basic combinatorial optimization problems. The sample problems will illustrate powerful techniques like constraint propagation and iterative optimization, which are invaluable to solving real-world optimization applications in supply chain and logistics. The tutorial will emphasize hands-on examples and their relationship to larger applications.

3:15–3:30 **Coffee Break** EE/CS 3-176

APPL. MATH. AND NUM. ANAL. SEMINAR, Vincent Hall 570:

3:30pm **Fernando Reitich** Shape deformations and analytic continuation in free
Univ. of Minnesota boundary problems

In this talk I will present a general approach to the analysis of steady states and nonlinear stability for a class of free-boundary problems. The approach is based on the explicit consideration of series solutions in a parameter measuring variations of domains (e.g. steady state or initial configurations) from separable geometries (e.g. planes, spheres, etc). The method relies on the derivation of formulas for the recursive evaluation of (Taylor) approximations of arbitrary order in the variation parameters, and on the iterative estimation of the growth, in appropriately defined spaces, of the resulting functional coefficients. We shall present a variety of instances where this procedure leads to general results on analyticity of solutions, on existence of complex steady states and on nonlinear stability of equilibria. Particular attention will be given to examples of "curvature driven" free-boundary problems, including the classical Stefan problems, models of capillary fluid drops, water waves, tumor growth, etc. We shall further show that the relevance of our studies goes beyond the theoretical, as it uncovered the mechanism behind the observed performance of a class of numerical algorithms, based on shape-perturbation theory, that have been used in these and other contexts. Indeed, our research shows that the standard implementations of these schemes can suffer from severe ill-conditioning as a result of pronounced cancellations in the underlying recursions. Moreover, our work further suggests alternative implementations with greatly improved properties of numerical stability and convergence, enhanced by methods of analytic continuation. As we shall demonstrate these modifications can have a dramatic effect on the accuracy and applicability of perturbative numerical approaches to (boundary value and) free-boundary problems.

6:00 pm **Tutorial Dinner** Mangia restaurant, 1501 University Ave. S.E.

Friday, September 13

All talks start in Lecture Hall EE/CS 3-180 unless otherwise noted.

9:00 **Coffee** EE/CS 3-176

9:30–11:15 **Jon Lee** Service Parts Logistics
IBM T.J. Watson Research Center

Abstract: Large spare-parts inventory and distribution logistics operations involve over 10K part numbers, with annual volume in the several M. In recent years, market forces have changed the way these services are sold and delivered. These changes are being made to address the needs to improve customer satisfaction and to drive down costs associated with service delivery. For example, the IBM/ITS North American maintenance organization focused on specific areas in order for IBM to drive down costs and improve the customer experience. Specifically, (i) a value-based pricing scheme tied to service levels, and (ii) a call screening process enabling remote diagnosis of problems. These changes led to challenging logistics requirements involving the deployment of labor and parts in order to satisfy contracted service levels while containing inventory and transportation costs.

The Optimization Center of the Mathematical Sciences Department at IBM Research and IBM's ITS/SPS organization, in collaboration with the Lehigh University Department of Industrial and Manufacturing Engineering have been developing a next generation logistics system designed for flexible and optimal control of spare parts inventories. IBM has migrated to a Parts Procurement Time (PPT) performance measure, which monitors whether the frequency at which parts are delivered to a customer location within a contractually determined time interval aggregated across machine service groups and geographies meet acceptable thresholds. I will describe the optimization model and algorithms that are currently being successfully deployed which have led to increased service, and reduced transportation costs, and dramatically reduced inventory costs.

10:30 am	Coffee Break	Reception Room EE/CS 3-176
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IMA/MCIM INDUSTRIAL PROBLEM SEMINAR, 570 Vincent Hall:

10:10 am	TBA
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The IMA/MCIM Industrial Problem Seminar is organized by Fadil Santosa

1:45-3:30	David Simchi-Levi MIT	Supply Chain Design Applications
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2:30-2:45	Coffee Break	EE/CS 3-176
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Monday, September 16

The 10:30 IMA break will be in Lind Hall 400.

OPTIMIZATION SEMINAR, Lind Hall 409:

11:15am	TBA
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Tuesday, September 17

The 10:30 IMA break will be in Lind Hall 400.

IMA POSTDOC INTRODUCTION EVENT, EE/CS 3-180:

10:00–3:45

14 IMA postdocs

Contact: Don Aaronson

The IMA postdocs give 10 minute presentations of their work.

APPL. MATH. AND NUM. ANAL. SEMINAR, Vincent Hall 570:

3:00pm

Guido Kanschat
U. Heidelberg

Multilevel-Preconditioning for Discontinuous Galerkin
Methods

Variants of a multi-level preconditioner for the interior penalty method are presented. They are analyzed in the framework established by Bramble/Pasciak for symmetric problems and shown to be optimal. Then, the methods are extended to other discontinuous discretizations of elliptic problems. Finally, they are applied to problems of computational fluid dynamics.

Wednesday, September 18

The 10:30 IMA break will be in Lind Hall 400.

Thursday, September 19

The 10:30 IMA break will be in Lind Hall 400.

Friday, September 20

The 10:30 IMA break will be in Lind Hall 400.

Monday, September 23

IMA Workshop:
The Role of Optimization in Supply Chain Management
September 23-27, 2002
Organizers: Brenda Dietrich (Mathematical Sciences, IBM T.J. Watson Research Center),
George Nemhauser (Georgia Institute of Technology), and David Simchi-Levi
(Engineering Systems, Massachusetts Institute of Technology)
See <http://www.ima.umn.edu/optimization/fall/op1.html>.

Supply chain management refers to the design, planning, procurement, production, and delivery of materials and other resources used in delivering both products and services to customers. Applications of supply chain management techniques can reduce costs and increase service levels. Supply chain management uses advanced information management and optimization models to design, plan and control the allocation of resources in the production and delivery of products and services.

This workshop will focus on the definition and formulation of large scale structured optimization problems that arise in supply chain management. It will emphasize new problems that are emerging in the movement away from traditional distribution and retail toward electronic commerce. The workshop will include academic researchers, leading industrial practitioners and representatives from advanced supply chain software companies.

In particular, the workshop will focus on:

- New algorithms and software capabilities

- New mathematical models that support new business models
- Methods for transforming vast amounts of data into knowledge to drive business decisions
- Real time algorithms to continually optimize in response to business and marketplace dynamics

The workshop will include presentations and discussions on topics such as:

- Dynamic pricing
- Supply chain design
- Supply chain coordination
- Advanced and complex marketplaces
- Combinatorial auctions
- Transportation optimization
- Service parts optimization
- Available-to-promise models
- Methods for dealing with uncertainty

All talks are in Lecture Hall EE/CS 3-180 unless otherwise noted.

8:30 am	Coffee and Registration	Reception Room EE/CS 3-176
9:15 am	Douglas N. Arnold, Scot Adams and Brenda Dietrich	Welcome and Introduction
9:30–10:20 am	Jeremy F. Shapiro Slim Technologies	Business Process Expansion to Exploit Optimization Models for Supply Chain Planning

Abstract: In a recent survey of leading manufacturers about supply chain planning systems, AMR Research found that success with these systems is more dependent on effective change management than technology. In this talk, we discuss aspects of change management, or business process expansion, that need to be better understood if supply chain managers are to more fully exploit optimization models in achieving competitive advantage. The topics to be discussed include:

- Differentiating transactional IT from analytical IT
- Designing and developing software to construct the supply chain decision database from an ERP database
- Understanding and modifying behavioral realities underlying organizational decision-making
- Reconciling exploration and exploitation in the development and use of optimization modeling systems
- Implementing business process expansion to achieve tactical supply chain planning supported by optimization models

10:20 am	Discussion	
10:30 am	Coffee Break	Reception Room EE/CS 3-176

11:00– 11:50 am	Ravindra K. Ahuja University of Florida	Network Optimization in Transportation Scheduling
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Abstract: In the past decades, many advances have taken place in road, air, and rail transportation scheduling and substantial savings have been obtained by using better modeling and optimization techniques. Many of the scheduling problems arising in transportation are currently solved using a series of models where the output of one model becomes the input of the next model. The current area of research in this field is to integrate multiple models allowing greater possibilities for improvement. However, integrated models are too large to be solved optimally using existing techniques. We have been involved in developing heuristic techniques to solve several such problems in transportation scheduling which combine neighborhood search techniques with linear and integer programming. The talk will describe some important problems in airline and railroad scheduling, and will outline algorithmic approaches we have developed to solve them. Computational results of these algorithms will also be presented.

11:50 am	Discussion	
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12:00 pm	Lunch Break	
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1:30–2:20 pm	Marshall Fisher University of Pennsylvania	Rocket Science Retailing: What research opportunities does it create for us?
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Abstract: Retailing is a big industry. In the U.S., retail business represents forty percent of the economy and is the largest employer. Retail supply chain management is still more art than science, but this is changing rapidly as retailers begin to apply analytic models to the huge volume of data they are collecting on consumer purchases and preferences. This industry-wide movement resembles the transformation of Wall Street that occurred in the 1970’s when physicists and other ‘rocket scientists’ applied their analytic skills to investment decisions.

The rocket science retailing movement will create enormous opportunities for our profession. To better understand these opportunities, Ananth Raman and I have been working with about 40 leading retailers to assess their progress towards rocket science retailing and to accelerate that progress through selected research projects with the retailers. This talk will describe findings from this work including:

- 1) How do retail supply chains function?
- 2) What decisions arise in retail supply chain management that lend themselves to analysis?
- 3) Synopsis of prior research on selected topics including managing short life cycle products to maximize life cycle profits, merchandise testing and store level assortment planning?
- 4) What are the exciting future research frontiers?

2:20 pm	Discussion	
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2:30 pm	Coffee Break	Reception Room EE/CS 3-176
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2:45–3:00 pm	Second chances	
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3:00 pm	IMA Tea/Poster Session	IMA East, 400 Lind Hall
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Poster Session	Tianbing Qian Motorola	Enterprise Capacity Planning at Motorola Semiconductors
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Abstract: Sales & Operations Planning (S&OP) is the business process in semiconductor industry where major capital

the inventory position at the beginning of each period. For the model with more general demand functions, we show that an (s, S, p) policy is not necessarily optimal. We introduce a new concept, the symmetric k -convex functions, and apply it to provide a characterization of the optimal policy. Surprisingly, in the infinite horizon case, the concept of symmetric k -convex functions allows us to show that a stationary (s, S, p) policy is optimal for both discounted and average profit models even for general demand functions.

11:50 am **Discussion**

12:00 pm **Lunch Break**

1:30–2:20 pm **Brenda Dietrich** Use of Optimization with IBM’s Supply Chain
IBM Research Center

Abstract: IBM uses optimization throughout its complex supply chain, in activities ranging from product design to production planning to reverse logistics. I will provide an overview of these activities, with details on a few of the more interesting ones.

2:20 pm **Discussion**

2:30 pm **Coffee Break** Reception Room EE/CS 3-176

3:00–3:50 pm **Jayashankar M. Swaminathan** Coordinating Prices on Traditional and Internet Channels
University of North Carolina, Chapel Hill

Abstract: The Internet has provided a new avenue to conduct business for both manufacturers and retailers. Two important decisions that need to be considered are - (1) the degree of independence of the new channel and (2) the pricing of goods across the two channels. In this talk, I will first introduce analysis of a monopolistic retailer and study alternative pricing strategies under different degrees of autonomy for the Internet operations using a micro level consumer utility model for demand generation. Next, I will discuss results considering the same issue from a manufacturer’s standpoint who has an existing retail channel. Finally, I will discuss theoretical bounds on the performance using a macro level demand model and provide insights on the pricing by pure and hybrid retailers (having both traditional and internet channel) under competition.

3:50 pm **Discussion**

Wednesday, September 25

All talks are in Lecture Hall EE/CS 3-180 unless otherwise noted.

9:00 am **Coffee** Reception Room EE/CS 3-176

9:30–10:20 am **Sridhar Tayur** From ‘Academic Building Blocks’ to Enterprise Opti-
Carnegie Mellon University (CMU) mization in Supply Chain Management

Abstract: Imbedding Optimization within the workflow at an enterprise-level is the current challenge in supply chain management. This is particularly difficult not only because of the data and user challenges, but also because the available

9:30–10:20 am	Awı Federgruen Columbia University	A General Equilibrium Model for Retail Industries with Price and Service Competition
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Abstract: This paper develops a stochastic general equilibrium inventory model for an oligopoly, in which all inventory constraint parameters are endogenously determined. We propose several systems of demand processes whose distributions are functions of all retailers’ prices and all retailers’ service levels. We proceed with the investigation of the equilibrium behavior of infinite horizon models for industries facing this type of generalized competition, under demand uncertainty.

We systematically consider the following three competition scenarios. (I) price competition only: here, we assume that the firms’ service levels are exogenously specified but characterize how the price and inventory strategy equilibrium varies with the chosen service levels. (II) simultaneous price and service level competition: here, each of the firms simultaneously chooses a service level and a combined price and inventory strategy. (III) two-stage competition: the firms make their competitive choices sequentially; in a first stage, all firms simultaneously choose a service level; in a second stage, the firms simultaneously choose a combined pricing and inventory strategy with full knowledge of the service levels selected by all competitors.

Joint work with Fernando Bernstein (Fuqua School of Business, Duke University, Durham, NC 27708).

10:20 am **Discussion**

10:30 am	Coffee Break	Reception Room EE/CS 3-176
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11:00– 11:50 am	Andy Boyd PROS Revenue Management, Inc.	Revenue Management and Dynamic Pricing in the Supply Chain
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Abstract: Supply chain management has historically focused on the planning, scheduling, and operational challenges encountered when supplying physical goods to the market. Equally important yet frequently neglected is the demand side of the equation, an area where the service industries have focused intensively. In particular, the travel and transportation industries have pioneered many highly successful demand management practices. Most notable among these practices is revenue management, which applies forecasting and optimization methodologies to address pricing and/or finished product inventory management. We discuss the role of revenue management and dynamic pricing in the overall value chain, discuss the underlying mathematical concepts that drive the value proposition, and highlight challenges.

11:50 am **Discussion**

12:00 pm **Lunch Break**

1:30–2:20 pm	Warren B. Powell Princeton University	Adaptive learning algorithms for stochastic resource allocation
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Abstract: One of the challenges arising in supply chain management is the need to make decisions before all the information is in. This arises in freight transportation when companies have to move equipment to handle the needs of shippers before their demands become known. The same problem is faced by manufacturers who have to plan what products to make before the size of a market is known, or by the same companies who have to decide how much product to ship to a location. In some cases, a company might want to provide a discount if a customer books an order in advance, in which case the company needs to determine the appropriate size of the discount. In addition to the uncertainty, most real problems are characterized by different types of resources or products and substitutable demands.

We propose an algorithmic strategy based on approximate dynamic programming which replaces the value function with a special class of functional approximations. The method requires using an unusual dynamic programming recursion, and easily handles very large scale problems. The strategy is provably optimal for some special cases, and appears to outperform provably optimal algorithms for more general cases because it has a much faster rate of convergence. It also

has the nice property of naturally producing integer solutions.

The talk will describe problems where the technique is being put into production, and outline some remaining research challenges.

2:20 pm	Discussion	
2:30 pm	Coffee Break	Reception Room EE/CS 3-176
3:00–3:50 pm	Alan King IBM Thomas J. Watson Research Center	Optimization Models for the Financial Valuation of Supply Chain Risks

Abstract: The valuation of financial options, as is well known, is based on the recognition that an option’s payouts can be replicated by a trading program that ”manufactures” an equivalent payout distribution from an initial infusion of cash equal to the value of the option. One may in fact develop a quite satisfactory and practical theory of options pricing based on an optimization formulation of this replication model as a multiperiod stochastic production-inventory problem. This talk will explore how this optimization-based valuation approach may be extended to the valuation and management of risky supply chain contracts.

3:50 pm	Discussion	
6:00 pm	Workshop Dinner	Gardens of Salonica, 19 NE 5th Street, Minneapolis, 612-378-0611

APPL. MATH. AND NUM. ANAL. SEMINAR, Vincent Hall 570:

11:30am	Dominik Schoetzau U. Basel	Mixed discontinuous Galerkin methods for saddle point problems
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We consider mixed discontinuous Galerkin methods for the discretization of saddle point problems. The main motivations for using discontinuous methods in these problems are their robustness in convection-dominated regimes, their flexibility in the mesh-design and their freedom in choosing element pairings without excessive stabilization.

We first discuss mixed discontinuous Galerkin methods for the Stokes operator in incompressible fluid flow. The derivation of these methods is explained for velocity-pressure elements of the type $Q_k - Q_k$ and $Q_k - Q_{k-1}$. It is shown that these elements satisfy suitable inf-sup conditions on geometric meshes in polygonal and polyhedral domains. A series of numerical results demonstrates that the methods perform well for a wide range of the Reynolds numbers.

We then apply similar techniques in the context of the time-harmonic Maxwell’s equations and present a new discontinuous Galerkin discretization of the Maxwell operator in mixed form chosen to provide control on the divergence of the electric field. Our theoretical results are tested in a series of numerical examples.

Friday, September 27

All talks are in Lecture Hall EE/CS 3-180 unless otherwise noted.

9:00 am	Coffee	Reception Room EE/CS 3-176
9:30–10:20 am	Robert C. Leachman University of California at Berkeley	Scheduling Dedicated Lithography Equipment

We will present a different, complementary approach to approximate dynamic programming, which we call price-directed control, that computes value function approximations directly using optimal dual prices of math programming models. These models are tractable relaxations of the underlying control problem. The resulting approximations are not subject to randomness and simulation error, and thus have more stable convergence properties. They also yield a bound against which the performance of any policy, including the price-directed policy, can be compared to obtain a guarantee relative to an optimal policy. Furthermore, duality theory can be exploited to discover economic and structural properties potentially useful to managers. However, the resulting models still can be challenging to solve, so there is opportunity for researchers to devise new computational techniques and paradigms in conjunction with new applications of the technique.

This talk will be a detailed case study on how to apply this approach in the context of inventory routing, which remains one of the most important unsolved problems in the supply chain.

2:20 pm

Discussion

Saturday, September 28

**IMA “Hot Topics” Workshop:
Operational Modeling and Biodefense: Problems,
Techniques, and Opportunities**

September 28, 2002

Organizers: Douglas N. Arnold (Director, IMA), Mac Hyman (Los Alamos National Laboratory), Edward H. Kaplan (Management Sciences, Yale University)

Cosponsored with the Society for Industrial and Applied Mathematics (SIAM) and with additional support from the University of Minnesota Consortium on Law and Values in Health, Environment & the Life Sciences.

See <http://www.ima.umn.edu/optimization/fall/biodefense.html>

Description:

Even before the September 11 terrorist attacks, the multiple threats posed by bioterrorism had been scrutinized for some time. The greatest attention has been devoted to identifying and classifying various offensive biological agents. The Centers for Disease Control describes three agent/disease categories in descending order of threat

(see <http://www.bt.cdc.gov/Agent/Agentlist.asp>).

The most serious concerns are those contained in Category A: anthrax, botulism, plague, smallpox, tularemia, and viral hemorrhagic fevers such as Ebola.

While epidemiologists and other medical scientists have invested considerable time and energy in describing the mode of transmission/spread and disease spectrum of potential offensive biological agents, much less attention has been devoted to the analysis of actual biodefense proposals. The deliberate mailing of anthrax and consequent illness and fatalities provided a bioterror “proof of concept,” and also illustrated the inadequacy of decision-making systems in place at the time to respond to such an attack. It seems clear that the actual logistics and operations of biodefense prevention and response policies, in addition to the specifics of whatever bioterror agents are involved, will determine the consequences of future bioterror attacks. In short, what we do to bioterror matters as much as what bioterror does to us.

This conference is the first to highlight the role of mathematical modeling in analyzing the operational and logistical aspects of biodefense planning and response. Presentations will range from discussions of the general threats posed by terrorism to global supply chains to the specifics of proposed emergency responses to a smallpox attack. Issues expected to surface include (but are not limited to) the personnel requirements and assignments required to respond to bioterror events; required inventories of various vaccines and their optimal deployment; and optimal quarantine and vaccination policy.

Throughout we will emphasize the importance of actual operations, whether in normally functioning systems (e.g. the US postal service) or in emergency response (e.g. contact tracing and vaccination).

This meeting will bring together a diverse group of scientists, engineers, and others from fields such as operations research, decision science, mathematics, economics, epidemiology, infectious disease, and public health to explore the use of mathematical techniques in countering the threat of terrorism.

All talks are in Lecture Hall EE/CS 3-180 unless otherwise noted.

8:30–8:50 am	Coffee and Registration	Reception Room EE/CS 3-176
8:50–9:00 am	Douglas N. Arnold and Scot Adams	Welcome and Introduction
9:00–9:45 am	Moshe Kress Center for Military Analyses, Israel	Operational and Logistical Aspects of Biodefense
9:45–10:05 am	Discussion	
10:05– 10:50 am	Martin I. Meltzer Center for Disease Control	Operational Modeling Opportunities in Biodefense
10:50– 11:10 am	Discussion	
11:10– 11:30 am	Coffee Break	Reception Room EE/CS 3-176
11:30 am– 12:15 pm	Martin I. Meltzer Center for Disease Control	Operational Modeling Opportunities in Biodefense
12:15– 12:35 pm	Discussion	
12:35– 2:00 pm	Lunch Break	
2:00–2:45 pm	Glenn Webb Vanderbilt University	Modeling the Spread of Anthrax through the Mail
3:05–5:30 pm	This time will be configured flexibly in response to the suggestions of participants and the preceding discussion. It will include short presentations, open discussion, and a closing panel/summary discussion on Problems, Techniques, and Opportunities in Biodefense.	
6:45 pm	Workshop Dinner	Oddfellows Restaurant, 401 East Hennepin Avenue, (612) 378-3179

Monday, September 30

The 10:30 IMA break will be in Lind Hall 400.

OPTIMIZATION SEMINAR, Lind Hall 409:

11:15am **TBA**

PART III: CURRENT IMA PARTICIPANTS

POSTDOCTORAL MEMBERS FOR 2002–2003 PROGRAM YEAR

NAME	PREVIOUS INSTITUTION
Yusuf Bilgin Altundas	Pittsburgh University
Olga Brezhneva	Russian Academy of Sci.
Dacian Daescu	University of Iowa
Gregory S. Duane	University of Colorado
Michael Efroimsky	Harvard and Oxford
Lisa Evans	Georgia Tech
Balaji Gopalakrishnan	Georgia Tech
Lili Ju	Iowa State University
Herve Kerivin	University Blaise Pascal-France
Daniel Kern	University of Illinois-Chicago
Aurilia Minut	Michigan State University
Haewon Nam	Texas A& M University
M. Yvonne Ou	University of Delaware
Tamon Stephen	University of Michigan
Jing Wang	University of Minnesota
Toshio Yoshikawa	University of Utah
Jun Zhao	Texas A& M University

POSTDOCTORAL MEMBERS IN INDUSTRIAL MATHEMATICS

NAME	PREVIOUS INSTITUTION	INDUSTRIAL AFFILIATION
Yusuf Altundas	University of Pittsburgh	Schlumberger
Lili Ju	Iowa State University	VA Hospital
Aurelia Minut	Michigan State University	3M
Haewon Nam	Texas A & M University	Schlumberger
Jun Zhao	Texas A & M University	GE

VISITORS IN RESIDENCE (as of 20 August 2002)

ADAMS, SCOT	Univ of Minnesota	SEP 7 - 8
ADELMAN, DAN	Univ of Chicago	SEP 22 - 27
AHUJA, RAVI	Univ of Florida	SEP 22 - 27
ALLEN, BETH	Univ of Minnesota	AUG 15 - DEC 31
ALTUNDAS, YUSUF BILGIN	Univ of Pittsburgh	SEP 3 - 2
ARNOLD, DOUG N.	IMA	SEP 1 - JUN 30
BAHN, DAVID	Metropolitan State Univ	SEP 10 - 13

BAHN, DAVID	Metropolitan State Univ	SEP 23 - 27
BALL, MICHAEL	Univ of Maryland	SEP 2 - 13
BARNHART, CINDY	MIT	SEP 7 - 13
BASSOK, YEHUDA	Univ of Southern California	SEP 22 - 28
BIENSTOCK, DANIEL	Columbia Univ	SEP 8 - 10
BIRGE, JOHN R.	Northwestern Univ	SEP 8 - 13
BIXBY, ROBERT E.	ILOG, Inc.	SEP 22 - OCT 19
BLOWER, SALLY	UCLA School of Medicine	SEP 27 - 28
BORUCKI, LEONARD	Motorola, Inc.	SEP 7 - 8
BOYD, ANDY	PROS Revenue Management, Inc.	SEP 25 - 27
BOYD, ANDY	PROS Revenue Management, Inc.	SEP 8 - 13
BREZHNEVA, OLGA	Russian Academy of Sciences	SEP 3, 2002 - SEP 2, 2003
BUCHMEIER, ANTON GEORG	Siemens	SEP 7 - 10
CALDERER, M. CARME	Univ of Minnesota	SEP 1 - JUN 30
CAULKINS, JONATHAN P.	Carnegie Mellon Univ	SEP 27 - 29
CLAYPOOL, ROBERT G.	Department of Veterans Affairs	SEP 27 - 28
COULLARD, COLLETTE	Northwestern Univ	SEP 1 - JUN 30
DAESCU, DACIAN	IMA	SEP 1 - JUN 30
DANILA, RICHARD	Minnesota Department of Health	SEP 27 - 28
DAVIS, TED	Univ of Minnesota, Twin Cities	SEP 7 - 8
DIETRICH, BRENDA	IBM Corporation	SEP 7 - 9, SEP 22 - 28
DONOHUE, KAREN	Univ of Minnesota	SEP 23 - 27
DUANE, GREGORY S.	IMA	SEP 1 - JUN 30
EFROIMSKY, MICHAEL	IMA	SEP 1 - JUN 30
EUBANK, STEPHEN	Los Alamos National Laboratory	SEP 27 - 28
EVANS, LISA	Georgia Institute of Technology	AUG 8 - 31
FEDERGRUEN, AWI	Columbia Univ	SEP 22 - 27
FISHER, MARSHALL L.	Univ of Pennsylvania	SEP 22 - 27
FOURER, ROBERT	Northwestern Univ	SEP 8 - 13
GLOCKNER, GREGORY	ILOG, Inc.	SEP 8 - 13
GOPAL, VIPIN	Honeywell	SEP 23 - 27
GOPALAKRISHNAN, BALAJI	Georgia Institute of Technology	SEP 3, 2002 - SEP 2, 2003
GUPTA, DIWAKAR	Univ of Minnesota	SEP 23 - 27
HILL, ARTHUR V.	Univ of Minnesota	SEP 11 - 13
JAIN, NARESH	Univ of Minnesota	SEP 7 - 8
JORDAN, RICHARD	Dynamic Technologies	SEP 27 - 28
JU, LILI	Iowa State Univ	SEP 3, 2002 - SEP 2, 2003
JUENGER, MICHAEL	Universitaet zu Koeln	SEP 8 - 13
KAMINSKY, PHILIP	Univ of California-Berkeley	SEP 22 - 27
KAPER, HANS	National Science Foundation	SEP 27 - 28
KAPLAN, EDWARD	Yale Univ	SEP 27 - 28
KATOK, ELENA	Penn State Univ	SEP 22 - 27
KEPLER, THOMAS	Duke Univ Medical Center	SEP 27 - 28
KERIVIN, HERVE	France Telecom R&D	AUG 26 - SEP 2
KERN, DANIEL	IMA	SEP 1 - JUN 30
KESKINOCAK, PINAR	Georgia Institute of Technology	SEP 22 - 27
KETTENRING, JON	Telcordia Technologies (Bellcore)	SEP 7 - 9
KING, ALAN	IBM T.J. Watson Research Center	SEP 22 - 28
KLAMPFL, ERICA ZIMMER	Ford Motor Company	SEP 7 - 10
KLAMPFL, ERICA ZIMMER	Ford Motor Company	SEP 21 - 27
KOOPMAN, JAMES	Univ of Michigan	SEP 27 - 28
KRESS, MOSHE	Center of Military Analyses, Israel	SEP 23 - 29
KRYLOV, NICOLAI	Univ of Minnesota	SEP 1 - AUG 31
LEACHMAN, ROBERT C.	Univ of California at Berkeley	SEP 22 - 27
LEE, JON	IBM, T.J. Watson Research Center	SEP 8 - 13
LIN, GRACE	IBM Corporation	SEP 22 - 27

LIU, HU	Univ of Minnesota	SEP 9 - 13
LIU, HU	Univ of Minnesota	SEP 23 - 27
LOWENGRUB, JOHN	Univ of Minnesota	SEP 1 - JUN 30
LUSTIG, IRVIN	ILOG	SEP 22 - 27
MAGAZINE, MICHAEL	Univ of Cincinnati	SEP 22 - 27
MARIN, SAMUEL	General Motors	SEP 7 - 9
MARTIN, ALEXANDER	Darmstadt Univ of Technology	SEP 29 - OCT 19
MCKENZIE, ELLIS	National Institutes of Health	SEP 27 - 28
MELNICHUK, VADIM	Metro State Univ	SEP 9 - 13
MELTZER, MARTIN	Center for Disease Control	SEP 27 - 28
MINUT, AURELIA	IMA	SEP 1 - AUG 31
MISEMER, DAVID	3M	SEP 7 - 9
MOEHRING, ROLF	Technische Universitat Berlin	SEP 22 - 28
NAM, HAEWON	Texas A&M Univ	SEP 3, 2002 - SEP 2, 2003
NAU, RICHARD	Carleton College	SEP 1 - DEC 31
NELSON, BLAINE	Synergy, Inc.	SEP 27 - 28
NEMHAUSER, GEORGE L.	Georgia Institute of Technology	SEP 8 - 13
NG, PEH	Univ of Minnesota-Morris Campus	AUG 1 - JUL 31
OU, M. YVONNE	IMA	SEP 1 - JUN 30
PAVELICH, JANET	Institute for Defense Analyses	SEP 27 - 29
PORCO, TRAVIS C.	San Francisco Dept of Public Health	SEP 27 - 28
POWELL, WARREN	Princeton Univ	SEP 22 - 27
QIAN, TIANBING	Motorola	SEP 22 - 28
QUEYRANNE, MAURICE	Univ of British Columbia	SEP 2 - DEC 20
ROBERTS, FRED	Rutgers Univ	SEP 27 - 28
ROMEIJN, H. EDWIN	Univ of Florida	SEP 22 - 27
ROSENTHAL, RICK	Naval Postgraduate School	SEP 22 - 28
ROUNDY, ROBIN	Cornell Univ	SEP 22 - 25
SANTOSA, FADIL	Univ of Minnesota	SEP 7 - 8
SAVELSBERGH, MARTIN	Georgia Institute of Technology	SEP 8 - 13, SEP 22 - 27
SCHULTZ, RUEDIGER	Gerhard-Mercator Univ Duisburg	SEP 29 - OCT 19
SCHULZ, ANDREAS	MIT	SEP 8 - 13
SCHWARTZ, IRA	Naval Research Lab	SEP 27 - 28
SELIM, SHOKRI Z.	King Fahd Univ of Petroleum & Minerals	SEP 21 - 28
SENDIL, M. NURI	Northwestern Univ	SEP 2 - JUN 30
SEYED, JAVAD	North Carolina State Univ	SEP 22 - 28
SHAPIRO, JEREMY F.	Slim Technologies	SEP 22 - 28
SHARP, DAVID	Los Alamos National Laboratory	SEP 7 - 9
SHEFFI, YOSSIE	MIT	SEP 22 - 27
SIEGMUND, STEFAN	Georgia Institute of Technology	APR 8 - SEP 19
SIMCHI-LEVI, DAVID	MIT	SEP 12 - 13
SIMCHI-LEVI, DAVID	MIT	SEP 22 - 27
SPERA, COSIMO	Saltare, Inc.	SEP 22 - 28
STARK, CHRIS	National Science Foundation	SEP 8 - 13
STEPHEN, TAMON	Univ of Michigan	AUG 12, 2002 - SEP 2, 2003
SULLIVAN, JOHN	Synergy, Inc.	SEP 27 - 28
SVERAK, VLADIMIR	Univ of Minnesota	SEP 1 - AUG 31
SWAMINATHAN, J.	Univ of North Carolina, Chapel Hill	SEP 22 - 27
TAYUR, SRIDHAR R.	Carnegie Mellon Univ	SEP 22 - 27
TEO, CHUNG-PIAW	National Univ of Singapore	SEP 22 - 27
TRICK, MICHAEL	Carnegie Mellon Univ	SEP 22 - 29
VAN OORTMERSSEN, GERARD	CWI	SEP 7 - 9
VENKATARAMANAN, LELITHA	Schlumberger-Doll Research	SEP 7 - 9
VENKATASUBRAMANYAN, N.	i2 Technologies	SEP 22 - 28
WANG, JING	Univ of Minnesota	SEP 3, 2002 - SEP 2, 2003
WEBB, GLENN	Vanderbilt Univ	SEP 27 - 28

WEERASINGHE, ANANDA	Iowa State Univ	SEP 8 - 10
WEIN, LAWRENCE M.	MIT	SEP 27 - 28
WILSON, AMY R.	Univ of Minnesota	SEP 27 - 28
WOLSEY, LAURENCE	Univ of Louvain	SEP 22 - 27
WOMBLE, DAVID	Sandia Laboratories	SEP 7 - 10
WU, DAVID	Lehigh Univ	SEP 22 - 28
YIN, KEWEN KAREN	Univ of Minnesota	SEP 9 - 13
YOSHIKAWA, TOSHIO	IMA	SEP 1 - JUN 30
ZELICOFF, ALAN	Sandia National Laboratories	SEP 27 - 28
ZHAO, JUN	Texas A&M Univ	SEP 3, 2002 - SEP 2, 2003
ZIPKIN, PAUL H.	Duke Univ	SEP 22 - 28

See also URL: <http://www.ima.umn.edu/people/>