

Railway Crew Rescheduling With Retiming

This book promotes the use of mathematical optimization and operations research methods in rail transportation. The editors assembled thirteen contributions from leading scholars to present a unified voice, standardize terminology, and assess the state-of-the-art. There are three main clusters of articles, corresponding to the classical stages of the planning process: strategic, tactical, and operational. These three clusters are further subdivided into five parts which correspond to the main phases of the railway network planning process: network assessment, capacity planning, timetabling, resource planning, and operational planning. Individual chapters cover: Simulation Capacity Assessment Network Design Train Routing Robust Timetabling Event Scheduling Track Allocation Blocking Shunting Rolling Stock Crew Scheduling Dispatching Delay Propagation

This is the first book to offer a complete spectrum of the role that operations research has played and can play in the improvement of North American freight railroads. It explores how decisions are made at railroads, contains examples of the mathematical programming formulations to the complex problems, and provides insights into real-world applications. The handbook is divided into eleven chapters, covering topics including scheduling problems, empty railcar distribution, and intermodal rail. These topics have been specifically selected to offer a thorough examination of the application of operations research at freight railroads. The chapters are written by recognized award-winning scholars and practitioners with a deep knowledge and understanding of their specific topics. The Handbook of Operations Research Applications at Railroads is an ideal resource for academics, experienced researchers, and consultants in the field.

What exactly is smart grid? Why is it receiving so much attention? What are utilities, vendors, and regulators doing about it? Answering these questions and more, *Smart Grids: Infrastructure, Technology, and Solutions* gives readers a clearer understanding of the drivers and infrastructure of one of the most talked-about topics in the electric utility market—smart grid. This book brings together the knowledge and views of a vast array of experts and leaders in their respective fields.

Key Features

- Describes the impetus for change in the electric utility industry
- Discusses the business drivers, benefits, and market outlook of the smart grid initiative
- Examines the technical framework of enabling technologies and smart solutions
- Identifies the role of technology developments and coordinated standards in smart grid, including various initiatives and organizations helping to drive the smart grid effort
- Presents both current technologies and forward-looking ideas on new technologies
- Discusses barriers and critical factors for a successful smart grid from a utility, regulatory, and consumer perspective
- Summarizes recent smart grid initiatives around the world
- Discusses the outlook of the drivers and technologies for the next-generation smart grid

Smart grid is defined not in terms of what it is, but what it achieves and the benefits it brings to the utility, consumer, society, and environment. Exploring the current situation and future challenges, the book provides a global perspective on how the smart grid integrates twenty-first-century technology with the twentieth-century power grid.

CRC Press Authors Speak

Stuart Borlase speaks about his book. Watch the video

Today many organizations face challenges when developing a realistic plan or schedule that provides the best possible balance between customer service and revenue goals. Optimization technology has long been used to find the best solutions to complex planning and scheduling problems. A decision-support environment that enables the flexible exploration of all the trade-offs and sensitivities needs to provide the following capabilities:

- Flexibility to develop and compare realistic planning and scheduling scenarios
- Quality sensitivity analysis and explanations
- Collaborative planning and scenario sharing
- Decision recommendations

This IBM® Redbooks® publication introduces you to the IBM ILOG® Optimization Decision Manager (ODM) Enterprise. This decision-support application provides the capabilities you need to take full advantage of optimization technology. Applications built with IBM ILOG ODM Enterprise can help users create, compare, and understand planning or scheduling scenarios. They can also adjust any of the model inputs or goals, and fully understand the binding constraints, trade-offs, sensitivities, and business options. This book enables business analysts, architects, and administrators to design and use their own operational decision management solution.

From the creator of the popular website *Ask a Manager* and New York's work-advice columnist comes a witty, practical guide to 200 difficult professional conversations—featuring all-new advice! There's a reason Alison Green has been called "the Dear Abby of the work world." Ten years as a workplace-advice columnist have taught her that people avoid awkward conversations in the office because they simply don't know what to say. Thankfully, Green does—and in this incredibly helpful book, she tackles the tough discussions you may need to have during your career. You'll learn what to say when

- coworkers push their work on you—then take credit for it
- you accidentally trash-talk someone in an email then hit "reply all"
- you're being micromanaged—or not being managed at all
- you catch a colleague in a lie
- your boss seems unhappy with your work
- your cubemate's loud speakerphone is making you homicidal
- you got drunk at the holiday party

Praise for *Ask a Manager*

"A must-read for anyone who works . . . [Alison Green's] advice boils down to the idea that you should be professional (even when others are not) and that communicating in a straightforward manner with candor and kindness will get you far, no matter where you work."—Booklist (starred review)

"The author's friendly, warm, no-nonsense writing is a pleasure to read, and her advice can be widely applied to relationships in all areas of readers' lives. Ideal for anyone new to the job market or new to management, or anyone hoping to improve their work experience."—Library Journal (starred review)

"I am a huge fan of Alison Green's *Ask a Manager* column. This book is even better. It teaches us how to deal with many of the most vexing big and little problems in our workplaces—and to do so with grace, confidence, and a sense of humor."—Robert Sutton, Stanford professor and author of *The No Asshole Rule* and *The Asshole Survival Guide*

"*Ask a Manager* is the ultimate playbook for navigating the traditional workforce in a diplomatic but firm way."—Erin Lowry, author of *Broke Millennial: Stop Scraping By and Get Your Financial Life Together*

Providing a comprehensive overview and analysis of the latest research in the growing field of public transport studies, this

Handbook looks at the impact of urbanisation and the growth of mega-cities on public transport. Chapters examine the significant challenges facing the field that require new and original solutions, including congestion and environmental relief, and the social equity objectives that justify public transport in cities.

Containing selected papers on the fundamentals and applications of Complexity Science, this multi-disciplinary book presents new approaches for resolving complex issues that cannot be resolved using conventional mathematical or software models. Complex Systems problems can occur in a variety of areas such as physical sciences and engineering, the economy, the environment, humanities and social and political sciences. Complexity Science problems, the science of open systems consisting of large numbers of diverse components engaged in rich interaction, can occur in a variety of areas such as physical sciences and engineering, the economy, the environment, humanities and social and political sciences. The global behaviour of these systems emerges from the interaction of constituent components and is unpredictable but not random. The key attribute of Complex Systems is the ability to self-organise and adapt to unpredictable changes in their environment.

Railway Crew Rescheduling with Retiming Handbook of Public Transport Research Edward Elgar Publishing

This volume presents a collection of rail orientated research articles, covering a variety of topics on rail operations research and management of rail systems as well as innovation, particularly focusing on sustainability aspects. The material consists of the most recent research work of the authors. The authorship is international, which makes it an interesting read for rail academics and professionals around the world. Although the material has a rail research focus the material is also excellent for preparation and delivery of rail, transport and logistics orientated courses and programmes. The target audience primarily comprises research experts in transport research, but the book may also be beneficial for graduate students alike.

This book reports on cutting-edge theories and methods for analyzing complex systems, such as transportation and communication networks and discusses multi-disciplinary approaches to dependability problems encountered when dealing with complex systems in practice. The book presents the most noteworthy methods and results discussed at the International Conference on Reliability and Statistics in Transportation and Communication (RelStat), which took place in Riga, Latvia on October 17 – 20, 2018. It spans a broad spectrum of topics, from mathematical models and design methodologies, to software engineering, data security and financial issues, as well as practical problems in technical systems, such as transportation and telecommunications, and in engineering education.

Building on the revolutionary Institute of Medicine reports *To Err is Human* and *Crossing the Quality Chasm, Keeping Patients Safe* lays out guidelines for improving patient safety by changing nurses' working conditions and demands. Licensed nurses and unlicensed nursing assistants are critical participants in our national effort to protect patients from health care errors. The nature of the activities nurses typically perform – monitoring patients, educating home caretakers, performing treatments, and rescuing patients who are in crisis – provides an indispensable resource in detecting and remedying error-producing defects in the U.S. health care system. During the past two decades, substantial changes have been made in the organization and delivery of health care and consequently in the job description and work environment of nurses. As patients are increasingly cared for as outpatients, nurses in hospitals and nursing homes deal with greater severity of illness. Problems in management practices, employee deployment, work and workspace design, and the basic safety culture of health care organizations place patients at further risk. This newest edition in the groundbreaking Institute of Medicine Quality Chasm series discusses the key aspects of the work environment for nurses and reviews the potential improvements in working conditions that are likely to have an impact on patient safety.

Haemin Sunim, a renowned Buddhist meditation teacher, illuminates a path to inner peace and balance amid the overwhelming demands of everyday life. He offers guideposts to well-being and happiness, and emphasizes the importance of forging a deeper connection with others and being compassionate and forgiving toward ourselves.

Optimization is of critical importance in engineering. Engineers constantly strive for the best possible solutions, the most economical use of limited resources, and the greatest efficiency. As system complexity increases, these goals mandate the use of state-of-the-art optimization techniques. In recent years, the theory and methodology of optimization have seen revolutionary improvements. Moreover, the exponential growth in computational power, along with the availability of multicore computing with virtually unlimited memory and storage capacity, has fundamentally changed what engineers can do to optimize their designs. This is a two-way process: engineers benefit from developments in optimization methodology, and challenging new classes of optimization problems arise from novel engineering applications. *Advances and Trends in Optimization with Engineering Applications* reviews 10 major areas of optimization and related engineering applications, providing a broad summary of state-of-the-art optimization techniques most important to engineering practice. Each part provides a clear overview of a specific area and discusses a range of real-world problems. The book provides a solid foundation for engineers and mathematical optimizers alike who want to understand the importance of optimization methods to engineering and the capabilities of these methods.

Workload transition is a potentially crucial problem in work situations wherein operators are faced with abrupt changes in task demands. People involved include military combat personnel, air-traffic controllers, medical personnel in emergency rooms, and long-distance drivers. They must be able to respond efficiently to sudden increases in workload imposed by a failure, crisis, or other, often unexpected, event. This book provides a systematic evaluation of workload transition. It focuses on a broad spectrum of activities ranging from team cooperation to the maintenance of this problem on a theoretical level and offers several practical solutions.

"TRB's National Cooperative Highway Research Program (NCHRP) Report 755: Comprehensive Costs of Highway-Rail Grade Crossing Crashes describes a process for estimating the costs of highway-rail grade crossing crashes. A spreadsheet-based tool to facilitate use of the cost estimation process is available online." --Publisher description.

Column Generation is an insightful overview of the state of the art in integer programming column generation and its many applications. The volume begins with "A Primer in Column Generation" which outlines the theory and ideas necessary to solve large-scale practical problems, illustrated with a variety of examples. Other chapters follow this introduction on "Shortest Path Problems with Resource Constraints," "Vehicle Routing Problem with Time Window," "Branch-and-Price Heuristics," "Cutting Stock Problems," each dealing with methodological aspects of the field. Three chapters deal with transportation applications: "Large-scale Models in the Airline Industry," "Robust Inventory Ship Routing by Column Generation," and "Ship Scheduling with Recurring Visits and Visit Separation Requirements." Production is the focus of another three chapters: "Combining Column Generation and Lagrangian Relaxation," "Dantzig-Wolfe Decomposition for Job Shop Scheduling," and "Applying Column Generation to Machine Scheduling." The final chapter by François Vanderbeck, "Implementing Mixed Integer Column

Generation," reviews how to set-up the Dantzig-Wolfe reformulation, adapt standard MIP techniques to the column generation context (branching, preprocessing, primal heuristics), and deal with specific column generation issues (initialization, stabilization, column management strategies).

This pioneering book addresses the latest research findings and application results on disruption management, which is the study of how to dynamically recover a predetermined operational plan when various disruptions prevent the original plan from being executed smoothly. This book contains the papers included in the proceedings of the 1st International Workshop on High-speed and Intercity Railways (IWHIR 2011) held in Shenzhen and Hong Kong, China from July 19 to July 22, 2011, which is organized by The Hong Kong Polytechnic University, in collaboration with Southwest Jiaotong University, Beijing Jiaotong University, Dalian Jiaotong University, China Engineering Consultants, Inc., Zhejiang University, and Tsinghua University. Continuing the great initiatives and momentums of the rapid development in high-speed and intercity railways worldwide in recent years, IWHIR 2011 aims at providing a platform for academic scholars and practicing engineers to share knowledge and experience, to promote collaboration, and to strengthen R&D activities related to railway engineering. Engineers, scientists, professors, and students from universities, research institutes, and related industrial companies have been cordially invited to participate in the workshop. These papers have covered a wide range of issues concerning high-speed and intercity railways in the theoretical, numerical, and experimental work pertaining to high-speed and intercity railways. Showcasing diversity and quality, these papers report the state-of-the-art and point to future directions of research and development in this exciting area.

Efficiency in the public and freight transportation systems is of crucial importance for a society. Railways can offer high capacity and relatively low environmental impact, but require that several technical systems are tuned and operate well. Specifically there is a very tight interdependency between infrastructure and trains, which distinguishes railways from other transportation modes. Thus maintenance of all the subsystems is needed. Railways do also have some specific and complicating properties that influence maintenance and operations: Most activities need exclusive access to the infrastructure and - due to the geographic layout, safety requirements and partitioning of the subsystems - large portions of the network will be affected by each activity. Furthermore, several organisational units and resources are involved, ranging from governments and regulatory bodies, over operators and contractors to suppliers, technical experts and work forces. Thus railway maintenance is complicated to organize and consumes large budgets. This thesis treats the planning and scheduling problems that concern railway infrastructure maintenance and the coordination with train traffic. Mathematical methods and optimization are studied and used, with the aim of advancing the knowledge about models for solving such problems. The thesis contains three papers and presents: (1) A survey regarding railway maintenance activities, the major planning problems and the conducted research so far; (2) A model for quantitative comparison and assessment of competing capacity requests from train operations and maintenance; (3) An optimization model for integrated scheduling of both maintenance windows and train services. The work can be helpful for practitioners as well as researchers who want to take further steps in this interesting and challenging area. Based on the results that have been obtained, future research directions are presented that may lead towards practical use of concurrent planning of railway maintenance and train services.

Scheduled transportation networks give rise to very complex and large-scale network optimization problems requiring innovative solution techniques and ideas from mathematical optimization and theoretical computer science. Examples of scheduled transportation include bus, ferry, airline, and railway networks, with the latter being a prime application domain that provides a fair amount of the most complex and largest instances of such optimization problems. Scheduled transport optimization deals with planning and scheduling problems over several time horizons, and substantial progress has been made for strategic planning and scheduling problems in all transportation domains. This state-of-the-art survey presents the outcome of an open call for contributions asking for either research papers or state-of-the-art survey articles. We received 24 submissions that underwent two rounds of the standard peer-review process, out of which 18 were finally accepted for publication. The volume is organized in four parts: Robustness and Recoverability, Robust Timetabling and Route Planning, Robust Planning Under Scarce Resources, and Online Planning: Delay and Disruption Management.

This book contains a selection of refereed papers presented at the "International Conference on Operations Research (OR 2013)" which took place at Erasmus University Rotterdam September 3-6, 2013. The conference was jointly organized by the German and the Dutch OR Society. More than 800 scientists and students from over 50 countries attended OR 2013 and presented more than 600 papers in parallel topical streams, as well as special award sessions. The theme of the conference and its proceedings is "Impact on People, Business and Society".

During the last decades, freight transportation experienced a worldwide boom. At the same time, competition increased considerably, such that efficient cost structures are indispensable for any market player. One of the main challenges a transportation company faces is the efficient employment of its personnel in operations, commonly referred to as crew scheduling. In this book the author presents solution approaches to large-scale crew scheduling. Firstly, the implementation of state-of-the-art operations research methods for a setting at a major European freight railway carrier is presented. Secondly, the author discusses acceleration techniques that make the developed algorithms applicable even in short-term contexts. While the analysis is based on European freight railway settings, the gained insights also apply to other (crew) scheduling contexts. Potential readership includes scholars and graduate students who are interested in the fields of crew scheduling and column generation as well as practitioners from transportation companies looking for new planning approaches.

This thesis is about mathematical optimization for the efficient use of railway infrastructure. We address the optimal allocation of the available railway track capacity - the track allocation problem. This track allocation problem is a major challenge for a railway company, independent of whether a free market, a private monopoly, or a public monopoly is given. Planning and operating railway transportation systems is extremely hard due to the combinatorial complexity of the underlying discrete optimization problems, the technical intricacies, and the immense sizes of the problem instances. Mathematical models and optimization techniques can result in huge gains for both railway customers and operators, e.g., in terms of cost reductions or service quality improvements. We tackle this challenge by developing novel mathematical models and associated innovative algorithmic solution methods for large scale instances. This allows us to produce for the first time reliable solutions for a real world instance, i.e., the Simplon corridor in Switzerland.

This NAO report examines how effectively the Strategic Rail Authority/Department for Transport and Network Rail turned around the West Coast programme between 2002 and 2006 in terms of delivering outputs and expected outcomes in line with the schedule and targets set by the government and set out in the West Coast Main Line Strategy of June 2003. Three areas were examined in detail: how the Strategic Rail Authority/Department of Transport and Network Rail addressed the weaknesses in programme management before 2002 to achieve delivery to schedule; whether costs have been brought under control; whether the programme is delivering its anticipated benefits. A number of findings and conclusions have been set out, including: that the SRA and Network Rail did turn around the programme through an industry-supported strategy, reducing technology risk through reliance on conventional signalling for most of the upgrade; there were some implementation problems in two areas, axle counters and computer-based interlocking signalling, which resulted in an increase in costs; in general, Network Rail's control of costs has improved, but an analysis of its reported and forecast expenditure shows a final programme spend of £8.6 billion, with an overspend of around £300 million; for renewal work on the west coast route, Network Rail is within its overall funding allowance and on course to achieve 70% of the £940 million cost efficiencies assumed by the rail Regulator; at present the Strategic Rail Authority provides subsidies on an annual basis to Virgin West Coast of £590 million in 2005-06 period, this amount represents a payment needed to maintain train services and is outside the £8.6 billion; the project has delivered journey time improvements, with

punctuality and train reliability on the West Coast having improved since 2005; in the 2005-06 period, passenger journeys on Virgin West Coast grew by over 20%, and the remaining work on the programme to 2009 will increase passenger train and freight capacity, but the consensus in the rail industry is that around 2015 to 2020, the line will have insufficient capacity to sustain current levels of growth in passenger and freight traffic; the overall strategy has delivered passenger benefits from a modernised track, but value for money for the programme has not been maximised. The report sets out a number of recommendations, including: that the Department in future should model and appraise costs and benefits for different options for the timing of delivery of the project; that the Department and the Office of Rail Regulation should further develop standard definitions for costs for different stages and elements of transport projects; where projects propose new technology at significant cost, the Department and ORR should ensure that Network Rail draws up a supporting business case, addressing costs, benefits and possible challenges along with a supporting implementation and maintenance strategy; the ORR should ensure Network Rail progresses its plans and adopts best practice strategy, and this approach should include a company-wide strategy that addresses whole life costs in its investment appraisal/project business cases, along with improved recording of maintenance and renewals costs for its equipment.

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