

# Lecture Notes in Control and Information Sciences



Edited by A.V. Balakrishnan and M. Thoma  
Series: IFIP TC7 Optimization Conferences

6

---

## Optimization Techniques

Proceedings of the  
8th IFIP Conference on Optimization Techniques  
Würzburg, September 5–9, 1977

### Part 1

---

Edited by J. Stoer

---



Fachbereich Mathematik  
Technische Hochschule Darmstadt  
Bibliothek

Inv.-Nr. B 16877

Springer-Verlag  
Berlin Heidelberg New York 1978

## TABLE OF CONTENTS

### INVITED SPEAKERS

Stochastic Optimization: Time-Continuous Data Models Balakrishnan, A.V. ....	1
Numerical Computation of Optimal Control Problems in Economy and Engineering Bulirsch, R.*	
Conjugate Direction Methods in Optimization Hestenes, M.R. ....	8
Mathematical Economics Hildenbrand, W.*	
Remarks on the Relationships between Free Surfaces and Optimal Control of Distributed Systems Lions, J.L. ....	28
Some Mathematical Models in Immunology Marchuk, G.I. ....	41
On Some Self-Immunization Mechanisms of Applied Mathematics: The Case of Catastrophe Theory Sussmann, H.J. ....	63
Methods for Nondifferentiable Optimization Wolfe, P.*	

### ROUND TABLE DISCUSSION ON WORLD MODELS

World Models de Jongh, D.C.J. ....	85
World Modeling Scolnik, H.D. ....	87
Limitations of World Models Tomović, R. ....	90

### COMPUTATIONAL TECHNIQUES IN OPTIMAL CONTROL

The Use of Nonlinear Programming in a Direct/Indirect Method for Optimal Control Problems Bartholomew-Biggs, M.C. ....	92
An Approximation of Time-Optimal Flights of a Supersonic Aircraft Diekhoff, H. *	
Approximation of Functional-Differential Equations by Ordinary Differential Equations and Hereditary Control Problems Kappel, F. ....	103

\*paper not received

Numerical Computation of Singular Optimal Control Problems with Application to Optimal Heating and Cooling by Solar Energy  
Oberle, H.\*

Numerical Computation of Optimal Flight Path Corrections  
Pesch, H.

An Algorithm to Obtain the Maximum Solution of the Hamilton-Jacobi Equation  
Gonzalez, R., Rofman, E. .... 109

Time Optimal Control of State Constrained Linear Discrete Systems  
Scott, M.P.J., Dickie, A.A. .... 117

Comparative Study on Numerical Methods for Solving Optimal Control Problems  
Well, K. \*

#### STOCHASTIC OPTIMAL CONTROL

A Robust Adaptive Procedure for Solving a Non Gaussian Identification Problem  
Benveniste, A., Goursat, M., Ruget, G. .... 128

Optimization and Uncertainty  
Drenick, R. .... 139

The Separation Principle for the Control of Linear Stochastic Systems with Arbitrary Information Structure  
Bagchi, A., Kwakernaak, H. .... 149

A Decomposition Scheme for the Hamilton-Jacobi Equation  
Maurin, S. .... 158

Calculation of Optimal Measurement Policies for Feedback Control of Linear Stochastic Systems  
Mellefont, D.J., Sargent, R.W.H. .... 166

On the Optimal Search for a Moving Target in Discrete Space  
Pursiheimo, U. .... 177

Optimal Maintenance and Inspection: An Impulsive Control Approach  
Robin, M. .... 186

Application of Open Loop Control to the Determination of Optimal Temperature Profile in the Chemical Reactor  
Socha, L., Skrzypek, J. .... 199

Output Regulation in Partially Observable Linear Disturbed Systems Sonnevend, Gy.	214
--	-----

Reaction of Continuous Dynamic Systems with Complex form under Time-Space Random Fields Waberski, A.	228
---	-----

#### DIFFERENTIAL GAMES

Pursuit by Two Pursuers Breakwell, J.*
---

On the Characterization and the Computation of the Characteristic Function of a Game without Side Payments Goffin, J.L., Haurie, A.	245
--	-----

Evasion in the Plane Leitmann, G., Liu, H.S.	255
---	-----

A Differential Game Approach to Collision Avoidance of Ships Olsder, G.J., Walter, J.L.	264
--	-----

A Method for Computing Nash Equilibria for Non-Zero-Sum Differential Games Tolwinski, B.	272
---	-----

#### OPTIMAL CONTROL OF PARTIAL DIFFERENTIAL EQUATIONS

Efficient Algorithms for Operator RICCATI Equations and Applications to Distributed Parameter Systems Baras, J.
--

Numerical Approximation and Identification in a 1-D Parabolic Degenerated Non-Linear Diffusion and Transport Equation Chavent, G., Cohen, G.	282
---	-----

Optimization of the Design of an In-Flight Refueling System Eichler, J.	294
--	-----

The FE and LP Method and the Related Methods for Optimization of Partial Differential Equation Systems Futagami, T.	303
--	-----

A Generalization of the Duality in Optimal Control and Some Numerical Conclusions Klötzler, R.	313
---	-----

On the Determination of Some Rheologic Properties of Mechanical Media Kluge, R., Langmach, H.*
---

On Optimal Damping of One-Dimensional Vibrating Systems Krabs, W. ....	321
Stability and Stabilizability of Linear Control Systems on HILBERT Space via Operator Dilation Theory Levan, N., Rigby, L. ....	332
On Discrete-Time Ritz-Galerkin Approximation of Control Constrained Optimal Control Problems for Parabolic Equations Lasiecka, I., Malanowski, K. ....	334
Numerical Aspects of a Parabolic Control Problem Mackenroth, U. *	
Optimal Design and Eigenvalue Problems Rousselet, B. ....	343
Optimal Control of Parabolic Boundary Value Problem Sachs, E. ....	353
A Variational Inequality Associated with a Stefan Problem Simulation and Control Saguez, C. ....	362
Numerical Methods for a Generalized Optimal Control Problem Simionescu, C.L. ....	370
A Cosine Operator Approach to Modelling Boundary Input Hyperbolic Systems Triggiani, R. ....	380
The Linearization of the Quadratic Resistance Term in the Equations of Motion for a Pure Harmonic Tide in a Canal and the Identification of the CHEZY Parameter C Volpi, G., Squazzero, P. ....	391
<u>IMMUNOLOGY, DISEASE AND CONTROL THEORY</u>	
Optimization of Ellipsoid-Clusters for Medical Differential Diagnosis DeClaris, N. *	
Stochastic Simulation of Space-Time Dependent Predator-Prey Models Dubois, D., Monfort, G. ....	400
Optimal Derivation of Antibody Distribution in the Immune Response from Noisy Data Bruni, C., Germani, A., Koch, G. ....	411
Compartmental Control Model of the Immune Process Mohler, R.R., Barton, C.F. ....	421

The IgM-IgG Switch Looked at from a Control Theoretic Viewpoint Perelson, A.S. ....	431
<u>ENVIRONMENTAL AND ENERGY SYSTEMS</u>	
Two-Level Optimization Techniques in Electric Power Systems Bielli,M., Calicchio, G., Cini,M., Nicolo,F. ....	441
Long Range Energy Planning for the Arab World Elshafei, A.*	
Multiobjective Programming and Siting of Industrial Plants Halbritter, G. ....	454
Economic Operation of Electric Power System under Environmental Impacts Harhammer, P.G. ....	467
An Optimum Operation of Pump and Reservoir in Water Supply System Nakahori, I., Sakaguchi, I., Ozawa, J. ....	478
Optimal Expansion of Generating Capacity in National Electric Power Energy System Ogino, K. ....	489
Pipeline Network Optimization- An Application to Slurry Pipelines Ulusoy,A.G., Miller, D.M. ....	500
Linear Fitting of Non-Linear Functions in Optimization. A Case Study: Air Pollution Problems Escudero, L.F., Vazquez-Muniz, A.M. ....	511

P A R T 2TABLE OF CONTENTSMATHEMATICAL PROGRAMMING, THEORY

Semi-Infinite Programming: Conditions of Optimality and Applications Hettich, R.P., Jongen, H.Th.	1
On Equiwellset Minimum Problems Zolezzi, T.	12
Second-Order Necessary and Sufficient Optimality Conditions for Infinite-Dimensional Programming Problems Maurer, H., Zowe, J.	13

NONLINEAR AND STOCHASTIC PROGRAMMING

An Underrelaxed Gauss-Newton Method for Equality Constrained Nonlinear Least Squares Problems Deuflhard, P., Apostolescu, V.	22
A Modification of Robinson's Algorithm for General Nonlinear Programming Problems Requiring only Approximate Solutions of Subproblems with Linear Equality Constraints Bräuninger, J.	33
Quadratic Approximation Problems from the Optimization Point of View Cromme, L. *	
On a Minimization Problem in Structural Mechanics Eckhardt, U.	42
Non-Linear Least Squares Inversion of an Integral Equation Using Free-Knot Cubic Splines Holt, J.N.	51
On the Convergence of the Modified TUI Algorithm for Minimizing a Concave Function on a Bounded Convex Polyhedron Bali, S., Jacobsen, S.E.	59
A Class of Algorithms for the Determination of a Solution of a System of Nonlinear Equations Kiekebusch-Müller, B.D.	67
Constrained Minimax Optimization Madsen, K., Schjaer-Jacobsen, H.*	
Stochastic Linear Programs with Random Data Having Stable Distributions Marti, K.	76

Methods of Feasible Directions with Increased Gradient Memory Meyer, G.G.L. ....	87
Semismooth and Semiconvex Functions in Constrained Optimization Mifflin, R.*	
The Continuous Method of Steepest Descent and its Discretizations Mitter, P., Ueberhuber, C.W. ....	94
Convergence Rate Results for a Penalty Function Method Nguyen, V.H., Strodiot, J.J. ....	101
A Combined Variable Metric - Conjugate Gradient Algorithm for a Class of Large Scale Unconstrained Minimization Problems Oren, S.S. ....	107
Simplex Method for Dynamic Linear Program Solution Krivonozhko, V.E., Propoi, A.I. ....	116
An Adaptive Precision Method for the Numerical Solution of Constrained Optimization Problems Applied to a Time-Optimal Heating Process Schittkowski, K. ....	125
Generalized Inverses and a New Stable Secant Type Minimization Algorithm Friedlander, A., Martinez, J.M., Scolnik, H.D. ....	136
A Conjugate Directions Method and its Application Sloboda, F. ....	147
The Development of an Efficient Optimal Control Package Sargent, R.W.H., Sullivan, G.R. ....	158
An Accuracy Selection Algorithm for the Modified Gradient Projection Method in Minimax Problems Szymanowski, J., Ruszcynski, A. ....	169
Single-Iterative Saddle-Point Algorithm for Solving Generally Constrained Optimization Problems Via Augmented LAGRANGEans Wierzbicki, A., Janiak, A., Kreglewski, T. ....	179
On One-Row Linear Programs Witzgall, C.*	
<u>INTEGER PROGRAMMING, NETWORKS</u>	
Improved Lower Bounds to 0/1. Problems via LAGRANGEan Relaxation d'Atri, G. ....	190

An Algorithm for the Solution of Assignment Problems Dorhout, B. *	
A Unified Approach to Reshipment, Overshipment and Post-Optimization Problems Finke, G. ....	201
Solving an Integer Programming Problem Hoang Hai Hoc ....	209
Worst Case Analysis for a Class of Combinatorial Optimization Algorithms Hausmann, D., Korte, B. ....	216
An Improved Method of Successive Optima for the Assignment Problem Mihalyffy, L. ....	225
Accelerated Greedy Algorithms for Maximizing Submodular Set Functions Minoux, M. ....	234
Resource Allocation in a Set of Networks under Multiple Objectives Petrovic, R. ....	244
An Algorithm for Solving the Generalized Transportation Problem Pogany, Z. ....	253
An Efficient Algorithm for Solving a Stochastic, Integer Programming Problem Arising in Radio Navigation Simundich, T.M. ....	263
Bottleneck Assignment Problems Slominski, L.*	
Using Pseudoboolean Programming in Decomposition Method Walukiewicz, S., ....	269
Solving the General Project Scheduling Problem with Multiple Constrained Resources by Mathematical Programming Slowinski, R., Weglarz, J. ....	278
Threshold Methods for Boolean Optimization Problems with Separable Objectives Zimmermann, U. ....	289
<u>URBAN SYSTEMS</u>	
Comparison of some Educational Planning Models Lukka, A. ....	299

Mathematical Programming in Health-Care Planning Minciardi, R., Puliafito, P.P., Zoppoli, R. ....	306
A Model of Housing Developing Costs Related to Location Costa Lobo, M.L., Valadares Tavares,L., Carvalho Oliveira,R. ..	316
An Optimum Surveillance and Control System for Synchronized Traffic Signals Cumani, A., Del Bello, R., Villa, A. ....	327
Regional Classification Problem and Weaver's Method Yajima, K. ....	338
A Mathematical Model for Decision Making in Public Service Planning Vicentini, P., Zanon, B. ....	343
<b><u>ECONOMICS</u></b>	
Optimal Control of Regional Economic Growth Hilhorst, M.T., Olsder, G.J., Strijbos, C.W. ....	350
System Modeling for Interconnected Dynamic Economy and the Decentralized Optimal Control Myoken, H., Uchida, Y. ....	360
Economic Consequences of a Change in Demographic Patterns: A Linear Programming Model Luptacik, M. ....	370
Dynamic Optimization Model of Man-Power System in Centrally Planned Economy Pstrokonksi, M. *	
<b><u>OPERATIONS RESEARCH</u></b>	
The Multiple Covering Problem and its Application to the Dimensioning of a Large Scale Seismic Network Archetti, F., Betro, B. ....	380
A Remark on Econometric Modelling, Optimization and Decision Making Cirina, M. ....	389
Formulation and Solution of the Sequencing Problem with Parallel Machines Grabowski, J. ....	400
Stochastic Model of Resource Allocation to R and D Activities under Cost Value Uncertainty Jakubowski, A. ....	411

Scheduling of Trains - An Optimization Approach Colding-Jørgensen, C., Jensen, O.H., Stig-Nielsen, P. ....	422
Optimal Portfolios where Proceeds are a Function of the Current Asset Price Miller, B.L. ....	434
An Algorithm for Optimal Sequencing of Aircraft in the Near Terminal Area Bianco, L., Nicoletti, B., Ricciardelli, S. ....	443
<u>COMPUTER AND COMMUNICATION NETWORKS, SOFTWARE PROBLEMS</u>	
A Mathematical Model of Traffic in Communication Networks Camoin, B. ....	454
Partitioning a Computer Network into Subnetworks and Allocation of Distributed Data Bases Kacprzyk, J., Stanczak, W. ....	464
Effective File Allocation Method onto Disc Devices Kondo, H., Yoshida, I., Kato, T. ....	473
Optimal File Allocation Problem and Relational Distributed Data Bases Mazzarol, G., Tomasin, E. ....	484
General Purpose Nonlinear Programming Package Rufer, D.F. ....	495