

# Table of Contents

---

<b>I</b>	<b>Introduction</b>	
Large-Scale PDE-Constrained Optimization: An Introduction . . . . .		3
<i>Lorenz T. Biegler, Omar Ghattas, Matthias Heinkenschloss,     Bart van Bloemen Waanders</i>		
<b>II</b>	<b>Large-Scale CFD Applications</b>	
Nonlinear Elimination in Aerodynamic Analysis and Design Optimization . . . . .		17
<i>D. P. Young, W. P. Huffman, R. G. Melvin, C. L. Hilmes,     F. T. Johnson</i>		
Optimization of Large-Scale Reacting Flows using MPSalsa and Sequential Quadratic Programming . . . . .		45
<i>A.G. Salinger, R.P. Pawlowski, J.N. Shadid,     B. van Bloemen Waanders, R. Bartlett, G.C. Itle, L. Biegler</i>		
<b>III</b>	<b>Multifidelity Models and Inexactness</b>	
First-Order Approximation and Model Management in Optimization . .		63
<i>Natalia M. Alexandrov, Robert Michael Lewis</i>		
Multifidelity Global Optimization Using DIRECT . . . . .		80
<i>Steven E. Cox, Raphael T. Haftka</i>		
Inexactness Issues in the Lagrange-Newton-Krylov-Schur Method for PDE-constrained Optimization . . . . .		93
<i>George Biros, Omar Ghattas</i>		
<b>IV</b>	<b>Sensitivities for PDE-based Optimization</b>	
Solution Adapted Mesh Refinement and Sensitivity Analysis for Parabolic Partial Differential Equation Systems . . . . .		117
<i>Shengtai Li, Linda R. Petzold, James M. Hyman</i>		
Challenges and Opportunities in Using Automatic Differentiation with Object-Oriented Toolkits for Scientific Computing . . . . .		133
<i>Paul Hovland, Steven Lee, Lois McInnes, Boyana Norris,     Barry Smith</i>		
Piggyback Differentiation and Optimization . . . . .		148
<i>Andreas Griewank, Christèle Faure</i>		

---

---

**V NLP Algorithms and Inequality Constraints**

---

Assessing the Potential of Interior Methods for Nonlinear Optimization .....	167
<i>José Luis Morales, Jorge Nocedal, Richard A. Waltz, Guanghui Liu, Jean-Pierre Goux</i>	
An Interior-Point Algorithm for Large Scale Optimization .....	184
<i>John T. Betts, Samuel K. Eldersveld, Paul D. Frank, John G. Lewis</i>	
SQP SAND Strategies that Link to Existing Modeling Systems .....	199
<i>Lorenz T. Biegler and Andreas Wächter</i>	
Interior Methods For a Class of Elliptic Variational Inequalities .....	218
<i>Randolph E. Bank, Philip E. Gill, Roummel F. Marcia</i>	
Hierarchical Control of a Linear Diffusion Equation .....	236
<i>Anthony J. Kearsley, Jon W. Tolle, Paul T. Boggs</i>	

---

**VI Time-Dependent Problems**

---

A Sequential Quadratic Programming Method for Nonlinear Model Predictive Control .....	253
<i>Kenneth R. Muske, James W. Howse</i>	
Reduced Order Modelling Approaches to PDE-Constrained Optimization Based on Proper Orthogonal Decomposition .....	268
<i>Marco Fahl, Ekkehard W. Sachs</i>	
Adaptive Simulation, the Adjoint State Method, and Optimization ....	281
<i>Mark S. Gockenbach, William W. Symes</i>	

---

**VII Frameworks for PDE-Constrained Optimization**

---

The SIERRA Framework for Developing Advanced Parallel Mechanics Applications .....	301
<i>James R. Stewart, H. Carter Edwards</i>	
rSQP++ : An Object-Oriented Framework for Successive Quadratic Programming .....	316
<i>Roscoe A. Bartlett, Lorenz T. Biegler</i>	
Sundance Rapid Prototyping Tool for Parallel PDE Optimization .....	331
<i>Kevin R. Long</i>	

---