

---

## Contents

<b>Perspectives on Automatic Differentiation: Past, Present, and Future?</b> <i>Louis B. Rall</i> .....	1
<b>Backwards Differentiation in AD and Neural Nets: Past Links and New Opportunities</b> <i>Paul J. Werbos</i> .....	15
<b>Solutions of ODEs with Removable Singularities</b> <i>Harley Flanders</i> .....	35
<b>Automatic Propagation of Uncertainties</b> <i>Bruce Christianson, Maurice Cox</i> .....	47
<b>High-Order Representation of Poincaré Maps</b> <i>Johannes Grote, Martin Berz, Kyoko Makino</i> .....	59
<b>Computation of Matrix Permanent with Automatic Differentiation</b> <i>Koichi Kubota</i> .....	67
<b>Computing Sparse Jacobian Matrices Optimally</b> <i>Shahadat Hossain, Trond Steihaug</i> .....	77
<b>Application of AD-based Quasi-Newton Methods to Stiff ODEs</b> <i>Sebastian Schlenkrich, Andrea Walther, Andreas Griewank</i> .....	89
<b>Reduction of Storage Requirement by Checkpointing for Time-Dependent Optimal Control Problems in ODEs</b> <i>Julia Sternberg, Andreas Griewank</i> .....	99

<b>Improving the Performance of the Vertex Elimination Algorithm for Derivative Calculation</b> <i>M. Tadjouddine, F. Bodman, J. D. Pryce, S. A. Forth</i> .....	111
<b>Flattening Basic Blocks</b> <i>Jean Utke</i> .....	121
<b>The Adjoint Data-Flow Analyses: Formalization, Properties, and Applications</b> <i>Laurent Hascoët, Mauricio Araya-Polo</i> .....	135
<b>Semiautomatic Differentiation for Efficient Gradient Computations</b> <i>David M. Gay</i> .....	147
<b>Computing Adjoint with the NAGWare Fortran 95 Compiler</b> <i>Uwe Naumann, Jan Riehme</i> .....	159
<b>Extension of TAPENADE toward Fortran 95</b> <i>Valérie Pascual, Laurent Hascoët</i> .....	171
<b>A Macro Language for Derivative Definition in ADiMat</b> <i>Christian H. Bischof, H. Martin Bücker, Andre Vehreschild</i> .....	181
<b>Transforming Equation-Based Models in Process Engineering</b> <i>Christian H. Bischof, H. Martin Bücker, Wolfgang Marquardt, Monika Peters, Jutta Wyes</i> .....	189
<b>Simulation and Optimization of the Tevatron Accelerator</b> <i>Pavel Snopok, Carol Johnstone, Martin Berz</i> .....	199
<b>Periodic Orbits of Hybrid Systems and Parameter Estimation via AD</b> <i>Eric Phipps, Richard Casey, John Guckenheimer</i> .....	211
<b>Implementation of Automatic Differentiation Tools for Multicriteria IMRT Optimization</b> <i>Kyung-Wook Jee, Daniel L. McShan, Benedick A. Fraass</i> .....	225
<b>Application of Targeted Automatic Differentiation to Large-Scale Dynamic Optimization</b> <i>Derya B. Özyurt, Paul I. Barton</i> .....	235
<b>Automatic Differentiation: A Tool for Variational Data Assimilation and Adjoint Sensitivity Analysis for Flood Modeling</b> <i>W. Castangs, D. Dartus, M. Honnorat, F.-X. Le Dimet, Y. Loukili, J. Monnier</i> .....	249

**Development of an Adjoint for a Complex Atmospheric Model, the ARPS, using TAF**  
*Ying Xiao, Ming Xue, William Martin, Jidong Gao* ..... 263

**Tangent Linear and Adjoint Versions of NASA/GMAO’s Fortran 90 Global Weather Forecast Model**  
*Ralf Giering, Thomas Kaminski, Ricardo Todling, Ronald Errico, Ronald Gelaro, Nathan Winslow* ..... 275

**Efficient Sensitivities for the Spin-Up Phase**  
*Thomas Kaminski, Ralf Giering, Michael Voßbeck* ..... 285

**Streamlined Circuit Device Model Development with FREEDA<sup>®</sup> and ADOL-C**  
*Frank P. Hart, Nikhil Kriplani, Sonali R. Luniya, Carlos E. Christoffersen, Michael B. Steer* ..... 295

**Adjoint Differentiation of a Structural Dynamics Solver**  
*Mohamed Tadjouddine, Shaun A. Forth, Andy J. Keane* ..... 309

**A Bibliography of Automatic Differentiation**  
*H. Martin Bückner, George F. Corliss* ..... 321

**References** ..... 323

**Index** ..... 355