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BOOK REPORTS

The Book Reports section is a regular feature of *Computers & Mathematics with Applications*. It is an unconventional section. The Editors decided to break with the longstanding custom of publishing either lengthy and discursive reviews of a few books, or just a brief listing of titles. Instead, we decided to publish every important material detail concerning those books submitted to us by publishers, which we judge to be of potential interest to our readers. Hence, breaking with custom, we also publish a complete table of contents for each such book, but no review of it as such. We welcome our readers' comments concerning this enterprise. Publishers should submit books intended for review to the Editor-in-Chief,

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Section 4. Geometry, Computer Graphics, and Art. 20. Dynamics, Chaos, and Design. 21. Paul Klee on Computer: Biomathematical Models Help Us Understand His Work. 22. Parameterized Sculpture Families, the Aesthetic Value of Optimal Geometry.

Section 5. Mathematics, Visualization, and Cinema. 24. Mathematics and Cinema. 25. Some Organizing Principles. 26. Figures and Characters in the Great Book of Nature. 27. Circle Packings and the Sacred Lotus. 28. Meander Mazes on Polyspericons.

Contributors

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The Man Behind the Microchip, Robert Noyce and the Invention of Silicon Valley Leslie Berlin, Oxford University Press, Oxford, NY, (2005), 402 pages, \$30.00.

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1. Adrenaline and Gasoline. 2. Rapid Robert. 3. Apprenticeship. 4. Breakaway. 5. Invention. 6. A Strange Little Upstart. 7. Upstart. 8. Takeoff. 9. The Edge of What's Barely Possible. 10. Renewal. 11. Political Entrepreneurship. 12. Public Startup.

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Handbook of Numerical Analysis, Volume XIII, Special Volume Numerical Methods in Electromagnetics Editor, P.G. Ciarlet, Elsevier North Holland, Amsterdam, (2005), 912 pages, \$259.00.

Contents of Volume XIII

Special Volume: Numerical Methods in Electromagnetics

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Preface. Introduction to Electromagnetism, Discretization of Electromagnetic Problems: The "Generalized Finite Differences" Approach, Finite-Difference Time-Domain Methods, Discretization of Semiconductor Device Problems (II), Modelling and Discretization of Circuit Problems, Simulation of EMC Behaviour, Solution of Linear Systems, Reduced-Order Modelling, Subject Index.

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Volume III. Techniques of Scientific Computer (Part 1), Historical Perspective of Interpolation, Approximation and Quadrature, Padé Approximations, Approximation and Interpolation Theory.

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Grammars with Context Conditions and Their Applications Alexander Meduna and Martin Svec, A John Wiley & Sons, Inc., Publication, Hoboken, NJ, (2005), 216 pages, \$79.95.

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The Numerical Solution of Ordinary and Partial Differential Equations, Second Edition Granville Sewell, John Wiley & Sons, Inc., Hoboken, NJ, 333 pages, \$89.95.

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Ratner's Theorems on Unipotent Flows Dave Witte Morris, University of Chicago Press, Chicago, IL, (2005), 203 pages, \$20.00.

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Error Correction Coding, Mathematical Methods and Algorithms Todd K. Moon, John Wiley & Sons Inc., Hoboken, NJ, (2005) 756 pages, \$130.00.

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Competition and Growth, Reconciling Theory and Evidence Phillippe Aghion, Rachel Griffith, MIT Press, Cambridge, MA, 104 pages, \$28.00.

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Wired For Speech, How Voice Activates and Advances the Human-Computer Relationship Clifford Nass, Scott Brave, MIT Press, Cambridge, MA, 296 pages, \$32.50.

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Advances In Neural Information Processing Systems 17 Edited By Lawrence K. Saul, Yair Weiss, and Leon Bottou, MIT Press, Cambridge, MA, 1668 pages, \$100.00.

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T1-89 Graphing Calculator for DUMMIES C.C. Edwards, Wiley Publishing, Inc., Hoboken, NJ, 338 pages, \$21.99.
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Parallel Metaheuristics, A New Class of Algorithms, Enrique Alba, John Wiley & Sons Inc., Hoboken, NJ, 554 pages, \$95.00.

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Encyclopedia of Mathematics and its Applications 99, Solving Polynomial Equation Systems II, Macaulay's Paradigm and Grobner Technology, Teo Mora, Cambridge University Press, Cambridge, NY, (2005), 759 pages, \$150.00.

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The Accident of Art, Sylvere Lotringer, Paul Virilio, The MIT Press, Cambridge, MA (2005), 119 pages, \$14.95.

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Representation and Inference for Natural Language, A First Course in Computational Semantics, P. Blackburn, Johan Bos, The University of Chicago (CSLI Publication), Chicago, IL, (2005), 350 pages, \$30.00.

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Ratner's Theorems on Unipotent Flows Dave Witte Morris, University of Chicago Press, Chicago, IL, (2005), 203 pages, \$20.00.

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Error Correction Coding, Mathematical Methods and Algorithms Todd K. Moon, John Wiley & Sons Inc., Hoboken, NJ, (2005) 756 pages, \$130.00.

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Competition and Growth, Reconciling Theory and Evidence Phillipe Aghion, Rachel Griffith, MIT Press, Cambridge, MA, 104 pages, \$28.00.

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Wired For Speech, How Voice Activates and Advances the Human-Computer Relationship Clifford Nass, Scott Brave, MIT Press, Cambridge, MA, 296 pages, \$32.50.

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Advances In Neural Information Processing Systems 17 Edited By Lawrence K. Saul, Yair Weiss, and Leon Bottou, MIT Press, Cambridge, MA, 1668 pages, \$100.00.

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T1-89 Graphing Calculator for DUMMIES C.C. Edwards, Wiley Publishing, Inc., Hoboken, NJ, 338 pages, \$21.99.
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Parallel Metaheuristics, A New Class of Algorithms, Enrique Alba, John Wiley & Sons Inc., Hoboken, NJ, 554 pages, \$95.00.

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Encyclopedia of Mathematics and its Applications 99, Solving Polynomial Equation Systems II, Macaulay's Paradigm and Grobner Technology, Teo Mora, Cambridge University Press, Cambridge, NY, (2005), 759 pages, \$150.00.

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The Accident of Art, Sylvere Lotringer, Paul Virilio, The MIT Press, Cambridge, MA (2005), 119 pages, \$14.95.

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