

## **R. Kevin Wood**

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### **EDUCATION**

Ph.D. in operations research, University of California at Berkeley, 1982. Studied combinatorial optimization, network and system reliability, computer science and statistics. Developed an efficient algorithm for computing the reliability of lifeline networks subject to seismic risk. Discovered new reductions for network reliability computations and characterized a class of networks that admit linear-time solutions. Developed and implemented an algorithm for probabilistic fault-tree analysis.

M.S. in Operations Research, Columbia University, 1978.

B.S. in Mathematics and B.S. in Electrical Engineering, University of Portland, 1977.

### **WORK EXPERIENCE**

Professor, Operations Research Department, Naval Postgraduate School. Research on mathematical programming, networks and interdiction, system reliability, 1998-present.

Associate Chair for Research, Operations Research Department, Naval Postgraduate School, 1999-2003, 2009-present.

Visiting Professor, Engineering Science Dept., University of Auckland, New Zealand. 2003-2004.

Distinguished Visiting Professor, Operations Research, Modeling and Simulation, National Security Agency. Summer 2000 and 2002.

Visiting Associate Professor, OR Department, Stanford University, 1995-1996.

Associate Professor, OR Department, Naval Postgraduate School, 1988-1998.

Assistant Professor, OR Department, Naval Postgraduate School, 1982-1988,

Member of Technical Staff, Bell Labs, Whippany, New Jersey. Analyzed the economics of using multiplexers for local customers. Developed a simulation for comparing multiplexing to wire, 1978-79.

### **RESEARCH AND TEACHING INTERESTS**

Linear, integer and stochastic programming and their applications  
Network and system interdiction, optimal protection of infrastructure

## **SECURITY CLEARANCE**

Top Secret (SCI)

## **HONORS AND AWARDS**

2000, 2002 Distinguished Visiting Prof. for Summer Program in OR Technology, National Security Agency  
1997, 1993 Naval Postgraduate School Research Recognition Award  
1984 Presidential Young Investigator Award, National Science Foundation

## **SCHOLARSHIPS**

Charles Fish Scholarship, U.C. Berkeley  
Columbia University Scholarship  
University of Portland Scholarship  
Tektronix Scholarship

## **SPECIAL SKILLS**

Fluent in Swedish  
Field-study experience with humpback whales

## **PROFESSIONAL ORGANIZATIONS**

Member, Institute for Operations Research and the Management Sciences  
Member, Society for Industrial and Applied Mathematics  
Director, Pacific Whale Foundation

## **OTHER ACTIVITIES**

Adviser, Research Associateship Program, National Research Council

## **GRANTS**

1990-pres. Principal Investigator, Large-Scale Optimization, Air Force Office of Scientific Research  
1989-pres. Principal Investigator, Large-Scale Optimization, Office of Naval Research  
2007-pres. Principal Investigator, Interdicting the IED Supply Chain, Joint Improvised Explosive Device Defeat Organization (JIEDDO)  
2005-2007 Principal Investigator, Reducing the Vulnerability of Electric Power Grids to Terrorist Attacks, Department of Energy  
2002-2005 Principal Investigator, Homeland Security (Protecting Electrical Power Grids), Department of Justice and Department of Homeland Security  
2002 Grantee, Defense University Research Instrumentation Program (IBM p690 Regatta multi-processor computer)

1999-2006 Principal Investigator, Large-Scale Optimization, National Security Agency

1995-2004 Principal Investigator, Large-Scale Optimization, Joint Warfare Analysis Center

1987 Principal Investigator, Large-Scale Integer Linear Optimization, Chief of Naval Operations

1987 Investigator, Large-Scale, Real-Time Network Optimization, Defense Nuclear Agency

1986 Investigator, Marine Corps Manpower Research Project, HQ Marine Corps

1984-1985 Principal Investigator, System Reliability Evaluation and Optimization, National Science Foundation

## PUBLICATIONS

- [1] Singh, K., Philpott, A. and Wood, K., 2009, "Dantzig-Wolfe Decomposition for Solving Multi-Stage Stochastic Capacity-Planning Problems," *Operations Research*, to appear.
- [2] Carlyle, W.M., Royset, J.O. and Wood, R.K., 2009, "Routing Military Aircraft with a Constrained Shortest-Path Algorithm," *Military Operations Research*, to appear.
- [3] Brown, G., Carlyle, M., Harney, R., Skroch, E. and Wood, K., 2009, "Interdicting a Nuclear Weapons Project," *Operations Research*, to appear.
- [4] Salmerón, J., Wood, K. and Baldick, R., 2009, "Worst-Case Interdiction Analysis of Large-Scale Electric Power Grids," *IEEE Transactions on Power Systems*, **24**, pp. 96-104.
- [5] Brown, G., Carlyle, M., and Wood, K., 2008, "Optimizing Department of Homeland Security Defense Investments: Applying Defender-Attacker (-Defender) Optimization to Terror Risk Assessment and Mitigation," Appendix E in *Department of Homeland Security Bioterrorist Risk Assessment: A Call for Change*, National Research Council report, National Academies Press, Washington, DC.
- [6] Pérez-Villalonga, F., Salmerón, J. and Wood, R.K., 2008, "Dynamic Evacuation Routes for Personnel on a Naval Ship," *Naval Research Logistics*, **55**, pp. 785-799.
- [7] Carlyle, W.M., Royset, J.O. and Wood, R.K., 2008, "Lagrangian Relaxation and Enumeration for Solving Constrained Shortest-Path Problems," *Networks*, **52**, pp. 256-270.
- [8] Singh, K., Philpott, A. and Wood, K., 2008, "Column Generation for Design of Survivable Electricity Distribution Networks," in review.
- [9] Royset, J.O. and Wood, R.K., 2007, "Solving the Bi-Objective Maximum-Flow Network-Interdiction Problem," *INFORMS Journal on Computing*, **19**, pp. 175-184.
- [10] Sanchez, S., and Wood, K., 2006, "The BEST Algorithm for Solving Stochastic Mixed Integer Programs," *Proceedings of the 2006 Winter Simulation Conference*, L. F. Perrone, F. P. Wieland, J. Liu, B. G. Lawson, D. M. Nicol, and R. M. Fujimoto, eds., pp. 765-773.
- [11] Harney, R., Brown, G., Carlyle, M., Skroch, E., and Wood, K., 2006, "Anatomy of a Project to Produce a First Nuclear Weapon," *Science and Global Security*, **14**, pp. 163-182.
- [12] Brown, G., Carlyle, M., Salmerón, J. and Wood, K., 2006, "Defending Critical Infrastructure," *Interfaces*, **36**, pp. 530-544.

- [13] Brown, G., Carlyle, M., Salmerón, J. and Wood, K., 2005, "Analyzing the Vulnerability of Critical Infrastructure to Attack, and Planning Defenses," in *Tutorials in Operations Research: Emerging Theory, Methods, and Applications*, H. Greenberg and J. Smith, eds., Institute for Operations Research and Management Science, Hanover, MD.
- [14] Brown, G., Carlyle, M., Diehl, D., Kline, J. and Wood, K., 2005, "A Two-Sided Optimization for Theater Ballistic Missile Defense," 2005, *Operations Research*, **53**, 263-275.
- [15] Carlyle, M. and Wood, K., 2005, "Near-Shortest and K-Shortest Simple Paths," *Networks*, **46**, pp. 98-109.
- [16] Silva, E. and Wood, K., 2005, "Solving a Class of Stochastic Mixed-Integer Programs with Branch and Price," *Mathematical Programming*, **108**, pp. 395-418.
- [17] Brown, G., Carlyle, M., Royset, J. and Wood, K., 2005, "On The Complexity of Delaying an Adversary's Project," in *The Next Wave in Computing, Optimization and Decision Technologies*, 2005, B. Golden, S. Raghavan and E. Wasil editors, Springer, New York, pp. 3-17.
- [18] Salmerón, J. Wood, K., and Baldick, R., 2004, "Analysis of Electric Grid Security Under Terrorist Threat," *IEEE Transactions on Power Systems*, **19**, pp. 905-912.
- [19] Balcioglu, A. and Wood, K., "Enumerating Near-Min s-t Cuts," 2003, in *Network Interdiction and Stochastic Integer Programming*, D.L. Woodruff, editor, Kluwer Academic Publishers, Boston, pp. 21-49.
- [20] Israeli, E. and Wood, K., 2002, "Shortest-Path Network Interdiction," *Networks*, **40**, pp. 97-111.
- [21] Brown, G., Keegan, J., Vigus, B. and Wood, K., 2001, "Production, Inventory and Distribution Planning at the Kellogg Company," *Interfaces*, **31**, 2001, pp. 1-15.
- [22] Appleget, J. and Wood, K., 2000, "Explicit-Constraint Branching for Solving Mixed-Integer Programs," in *Computing Tools for Modeling, Optimization and Simulation*, M. Laguna and J.L. González-Velarde, Kluwer Academic Publishers, Boston, pp. 245-261.
- [23] Morton, D. and Wood, K., 1999, "Restricted-Recourse Bounds for Stochastic Linear Programming," *Operations Research*, **47**, pp. 943-956.
- [24] Mak, W.-K., Morton, D. and Wood, K., "Monte Carlo Bounding Techniques for Verifying Solution Quality in Stochastic Programs," *Operations Research Letters*, **24**, 1999, pp. 47-56.
- [25] Cormican, K., Morton, D., and Wood, K., 1998, "Stochastic Network Interdiction," *Operations Research*, **46**, pp. 184-197.
- [26] Morton, D. and Wood, K., 1998, "On a Stochastic Knapsack Problem and Generalizations," in *Advances in Computational and Stochastic Optimization, Logic Programming, and Heuristic Search: Interfaces in Computer Science and Operations Research*, D.L. Woodruff, editor, pp. 149-168.
- [27] Brown, G., Dell, R., and Wood, K., 1998, "Optimization and Persistence," *Interfaces*, **27**, pp. 17-37.
- [28] Washburn, A. and Wood, K., 1995, "Two-Person Zero Sum Games for Network Interdiction," *Operations Research*, **43**, pp. 243-251.
- [29] Wood, K., 1993, "Deterministic Network Interdiction," *Mathematical and Computer Modelling*, **17**, pp. 1-18.
- [30] DeWolfe, D., Stevens, J., and Wood, K., 1993, "Setting Military Reenlistment Bonuses," *Naval Research Logistics*, **40**, pp. 143-160.

- [31] Lange, H. and Wood, K., 1992, "Solution of Large-Scale Multicommodity Network Flow Problems via a Logarithmic Barrier Function Decomposition," in *Operations Research Proceedings 1990*, Deutsche Gesellschaft für Operations Research, V.W. Buhler, G. Feichtinger, R. F. Hartl, F. J. Radmacher and P. Stahly editors, pp. 324-333.
- [32] Avery, W., Brown, G., Rosenkranz, J. and Wood, K., 1992, "Optimization of Purchase, Storage and Transmission Contracts for Natural Gas Utilities," *Operations Research*, 40, pp. 446-462.
- [33] Brown, G., Clemence, R., Teufert, W. and Wood, K., 1991, "An Optimization Model for Army Helicopter Fleet Modernization," *Interfaces*, 21, pp. 39-52.
- [34] Brown, G., Goodman, C. and Wood, K., 1990, "Annual Scheduling of Atlantic Fleet Naval Combatants," *Operations Research*, 38, pp. 249-259.
- [35] Wood, K., 1989, "Triconnected Decomposition for Computing K-Terminal Network Reliability," *Networks*, 19, pp. 203-220.
- [36] Lewis, P., Ressler, R. and Wood, K., 1989, "Variance Reduction Using Nonlinear Controls and Transformations," *Communications in Statistics, Simulation and Computation*, 18(2), pp. 665-672.
- [37] McCullers, W. and Wood, K., 1988, "Probabilistic Analysis of Fault Trees Using Pivotal Decomposition," in *Applications of Discrete Mathematics*, Ringeisen, R. D. and Roberts, F. S. eds., SIAM, Philadelphia.
- [38] Wood, K., 1986, "Factoring Algorithms for Computing K-Terminal Network Reliability," *IEEE Transactions on Reliability*, R-35(3), pp. 269-278.
- [39] Brown, G., McBride, R. and Wood, K., 1985, "Extracting Embedded Generalized Networks from Linear Programming Problems," *Mathematical Programming*, 32, pp. 11-31.
- [40] Wood, K., 1985, "A Factoring Algorithm for Computing K-Terminal Network Reliability," *Networks*, 15, pp. 173-190.
- [41] Satyanarayana, A. and Wood, K., 1985, "A Linear-Time Algorithm for Computing K-Terminal Reliability in Series-Parallel Graphs," *SIAM Journal on Computing*, 14, pp. 818-832.
- [42] Moghtaderizadeh, M., Der Kiureghian, A., Barlow, R. and Wood, K., 1982, "Seismic Reliability of Lifeline Networks," *Journal of the Technical Councils, ASCE*, 108(TC1), pp. 60-78.
- [43] Barlow, R.E., Der Kiureghian, A., Moghtaderizadeh, M., Sato, T. and Wood, R.K., 1981, "Seismic Reliability of Flow and Communication Networks," *Lifeline Earthquake Engineering, The Current State of Knowledge 1981*, Proceedings of the Second TCLEE Specialty Conference, ASCE, J. Smith editor, American Society of Civil Engineers, pp. 81-96.

## RECENT PRESENTATIONS

- [1] Newman, A. and Wood, K., "Open-Pit Mine Scheduling: Modeling and Computational Improvements," Workshop on Operations Research in Mining, Viña del Mar, Chile, 10-12 December 2008.
- [2] Wood, K., "Decomposition Methods for Designing Systems that Are Robust Against Attack," Workshop III: Beyond Internet MRA: Networks of Networks, Institute for Pure and Applied Mathematics, University of California, Los Angeles, 3-7 November 2008.

- [3] Wood, K. and Alvarez, P., "Solving Defender-Attacker-Defender Models for Defending Critical Infrastructure," INFORMS Annual Meeting, Washington, DC, 12-15 October 2008.
- [4] Morton, D., Dimitrov, N., Nehme, M. and Wood, K., "Interdicting Smuggled Nuclear Material," INFORMS Annual Meeting, Washington, DC, 12-15 October 2008.
- [5] Brown, G., Carlyle, M., Ghaffar, A., Kline, K. and Wood, K., "Optimizing Positions of Port Defense Radar Picket Ships- A Defender-Attacker Model," INFORMS Annual Meeting, Washington, DC, 12-15 October 2008.
- [6] Alvarez, P. and Wood, K., "DADs for Protecting Critical Infrastructure," INFORMS Annual Meeting, Seattle, WA, 4-7 November 2007.
- [7] Brown, G., Carlyle M., Harney R., Skroch E., Wood, K., 2007, "Interdicting a Nuclear Weapons Project," INFORMS Annual Meeting, Seattle, WA, 4-7 November 2007.
- [8] Brown, G., Carlyle, M. and Wood, K., "Trilevel Optimization of Homeland Defense Problems," RISK: Perception, Policy & Practice Workshop, SAMSI, Research Triangle Park, NC, October 3-4, 2007.
- [9] Newman, A. and Wood, K., "The Open Pit Mine Production Scheduling Problem," INFORMS Annual Meeting, Seattle, WA, 4-7 November 2007.
- [10] Salmeron, J. and Wood, K., "Bilevel and Trilevel Models for Electric Power Grid Interdiction and Defense, INFORMS Annual Meeting, Seattle, WA, 4-7 November 2007.
- [11] Brown, G., Carlyle, W.M., Salmeron, J. and Wood, K., "Trilevel Models for Protecting Critical Infrastructure," INFORMS Annual Meeting, Pittsburgh, PA, 13-16 November 2006.
- [12] Brown, G., Carlyle, W.M., Salmeron, J. and Wood, K., "Fast Detection of A Biological Agent Attack on the Washington D.C. Metro," National Research Council Committee on Methodological Improvements to the Department of Homeland Security's Biological Agent Risk Analysis, Washington, DC, 11 August 2006.
- [13] Brown, G., Carlyle, W., Salmeron, J. and Wood, K., "Attack and Defense of Critical Infrastructure," REDTEAM 2006, Albuquerque, NM, 2-4 May 2006.
- [14] Brown, G., Carlyle, W.M., Salmeron, J. and Wood, K., "Bilevel And Trilevel Models For Defending Critical Infrastructure: Risk Analysis Without The Risk," Risk Symposium 2006, Santa Fe, NM, 20-22 March 2006.
- [15] Salmeron, J., Wood, K., and Baldick, R., "Protecting An Electric Power Grid From Terrorists," REDTEAM 2006, Albuquerque, NM, 2-4 May 2006.
- [16] Sanchez, S.M. and Wood, R.K., "The 'BEST' Algorithm for Solving Stochastic Mixed Integer Programs," 2006 Winter Simulation Conference, Monterey, CA, 3-6 December 2006.