

# ROBERT J. VANDERBEI

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Operations Research and  
Financial Engineering  
Princeton University



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## EDUCATION

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### *Cornell University*

**Ph.D. in Applied Mathematics** 1981

*Dissertation Title: "Toward a Stochastic Calculus for Several Markov Processes"*

*Advisor: E.B. Dynkin*

*Thesis Committee: F. Spitzer, H.M. Taylor*

**M.S. in Applied Mathematics** 1979

### *Rensselaer Polytechnic Institute*

**M.S. in Operations Research and Statistics** 1978

**B.S. in Chemistry** 1976

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## HONORS

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**Member** Institute for Advanced Study 2019–2020

**Khachiyan Prize** INFORMS Optimization Society 2017

**Fellow** American Mathematical Society (AMS) 2014

**Fellow** Society for Industrial and Applied Mathematics (SIAM) 2012

**Fellow** Institute for Ops. Res. and Mgmt. Sciences (INFORMS) 2006

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## RESEARCH INTERESTS

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Interior-point methods for linear and nonlinear optimization, semi-definite programming, robust optimization, probabilistic potential theory, optimization models for high contrast imaging, the search for exosolar planets, stable periodic solutions to the  $n$ -body problem, and the stability of Saturn-like ring systems.

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EMPLOYMENT/POSITIONS

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*Princeton University*

**Department Chair**

Operations Research and Financial Engineering 2005 – 2012

**Professor**

Operations Research and Financial Engineering 1999 –

Civil Engineering and Operations Research 1996 – 1999

**Affiliated Member**

Mechanical and Aerospace Engineering 2011 –

Astrophysics 2006 –

Mathematics 2003 –

Computer Science 2000 –

Applied and Computational Mathematics 1994 –

**Associate Professor**

Civil Engineering and Operations Research 1991 – 1996

**Visiting Lecturer**

Civil Engineering and Operations Research 1990 – 1991

*AT&T Bell Laboratories*

**Member of Technical Staff**

Mathematics Research Center 1987 – 1991

Advanced Decision Support Systems 1985 – 1987

Performance Analysis Department 1984 – 1985

*University of Illinois at Urbana-Champaign*

**Postdoc**

Mathematics 1982 – 1984

*Courant Institute of Mathematical Sciences at NYU*

**NSF Postdoctoral Research Fellow**

Mathematics 1981 – 1982

*Summer Jobs*

**Cornell,** Calculus Instructor 1979

**Citibank,** Summer Intern 1976, 1977, 1978

**Stauffer Chemical Company,** Gas Chromatography of Vinyl Chloride 1975

**Amway,** Statistical Analysis of Tergotometer Data 1974

**Grand Rapids Junior College,** Organic Chemistry Lab Assistant 1972, 1973

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PLENARY TALKS

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*The Parametric Self-Dual Simplex Method – A Modern Perspective*, **Distinguished Lecture, Omega Rho**, Seattle WA, October 2019.

*Sparsity Matters*, **Khachiyan Prize Talk, INFORMS**, Houston TX, October 2017.

*Numerical Optimization Applied to Space-Related Problems*, **Distinguished Alumni Colloquium**, Cornell University, November 2016.

*Fast Fourier Optimization*, **Optimization Days**, GERAD, Montreal CA, May 2013.

*Linear Optimization*, **Machine-Learning Summer School**, LaPalma Canary Islands, April 2012.

*Optimization in Engineering Design*, **Computational Engineering and Science**, Lehigh University, October 2009.

*Extreme Optics and the Search for Earth-Like Planets*, **ISMP**, Rio de Janeiro, August 2006.

*Nonlinear Programming and Engineering Applications* (tutorial), **INFORMS**, Denver, October 2004.

*Engineering Applications of Nonlinear Optimization*, **AIRO**, Venice Italy, September 2003.

*New Directions in Linear Programming*, **INFORMS**, Miami Beach, FL, October 2001.

*Interior-Point Methods for Second-Order Cone Programming*, **5th International Conference on High Performance Optimization Techniques**, Rotterdam, NETHERLANDS, June 2000.

*Interior-Point Methods for Semidefinite Programming*, **5th International Conference on High Performance Optimization Techniques**, Rotterdam, NETHERLANDS, June 2000.

*Interior-point methods for nonlinear programming and Interior-point methods for second-order cone programming and semidefinite programming*, **Twenty-fifth Conference on the Mathematics of Operations Research**, Lunteren, NETHERLANDS, January 2000.

*Nonlinear Optimization: Algorithms and Models*, **Large-Scale Nonlinear Optimization**, Erice, SICILY, July 2001.

*Switching among Several Brownian Motions*, **Twentieth Conference on Stochastic Processes and their Applications**, Nahariya, ISRAEL, June 1991.

*Interior Methods for Linear Programming*, **Operations Research Society of Israel**, Tel-Aviv University, ISRAEL, May 1987.

*Constructing Strong Markov Processes*, **12th Midwest Probability Symposium**, Northwestern University, October 1984.

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## GRANTS

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**Office of Naval Research** (2016–2019) *Efficient Optimization via Sparsification with Applications to Fast Fourier Optimization, Compressive Sensing, and other Machine-Learning Problems*, principal investigator

**Office of Naval Research** (2013–2015) *Fast Fourier Optimization with Application to Antenna Array Control and High-Contrast Imaging*, principal investigator

**Jet Propulsion Laboratory** (2004–2005, 2010–2012) *Concept Study of Pupil Mapping for High-Contrast Imaging*, principal investigator

**Ball Aerospace** (2005–2005) *Truss-topology optimization for the High-Contrast Imaging Testbed*, principal investigator

**Jet Propulsion Laboratory** (2001–2006) *Optimizing the Design of High-Contrast Coronagraph for the Terrestrial Planet Finder*, principal investigator

**Office of Naval Research.** (1997–2008) *Interior-Point Methods for Nonlinear Optimization and Complementarity*, principal investigator

**National Science Foundation.** (1995–2004) *Interior Point Methods for Large Scale Nonlinear Programming*, principal investigator

**Air Force Office of Scientific Research** (1991–1998) *Robust Optimization of Large-Scale Systems: An Emerging Technology*, principal investigator

Co-investigator on several other grants

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## UNIVERSITY SERVICE

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Department Chair	2005–2012
Task Force Member, SEAS Strategic Planning	2014–2016
Committee Member, Discipline	2014–2016
Committee Member, Grading	2008–2012
Committee Member, Appointments and Advancements (C/3)	2007–2008
Committee Chair, Classrooms and Schedules	2005–2007
Committee Member, Course of Study	2001–2005
Director of Graduate Studies (DGS), ORFE	2003–2005
Program Director, Engineering and Management Systems	1994–2003
Committee Member, Engineering and Management Systems	1991–1994, 2019–

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## PROFESSIONAL ACTIVITIES

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Beale-Orchard Hayes Award Committee, Chair	1995–1997
Beale-Orchard Hayes Award Committee, Member	1993–1994
INFORMS Khachiyani Prize Award Committee, Chair	2019

INFORMS Subdivisions Council, Member	2010–2012
INFORMS Sections and Societies Committee, Member	2010–2012
INFORMS Computing Society, Chair	2010–2011
INFORMS Computing Society, Chair-Elect	2008–2009
INFORMS Computing Society Prize Committee, Member	1999–2000
INFORMS Expository Writing Award Committee, Chair	2003
INFORMS Expository Writing Award Committee, Member	2001–2002
INFORMS Nicholson Prize Committee, Member	1995
INFORMS Optimization Section, Chair	1999–2001
INFORMS Optimization Section Prize Committee, Chair	1999–2000
Princeton Public Library, Resident Scientist	2019
SIAG-OPT Optimization Prize Committee, Chair	2005, 2008
SIAG-OPT, Vice-Chair	2004–2008
Univ. of Michigan, Ind. and Ops. Engr. Dept., Member Advisory Board	1995–2000

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#### EDITORIAL POSITIONS

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Associate Editor, <i>Operations Research</i>	2015–2018
Editorial Board, <i>Optimization Methods and Software</i>	2014–
Associate Editor, <i>Optimization in Engineering</i>	2001–2005, 2014–
Editorial Board, <i>Foundations and Trends in Optimization</i>	2012–
Editorial Advisory Board, <i>Mathematical Programming Computation</i>	2008–
Associate Editor, <i>Mathematical Programming</i>	2003–2005
Associate Editor, <i>INFORMS Journal on Computing</i>	1991–2001

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#### MEMBERSHIPS IN PROFESSIONAL SOCIETIES

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American Astrophysical Society (AAS)	2002–
American Mathematical Society (AMS)	1977–
American Society of Engineering Education (ASEE), Member	2005–2017
Bernoulli Society	1983–2001
International Society for Optical Engineering (SPIE), Senior Member	2002–
Institute for Mathematical Statistics (IMS)	1980–2001
Institute for Operations Research and Mgmt. Sciences (INFORMS)	1994–
Mathematical Association of America (MAA)	1987–
Mathematical Programming Society (MPS)	1985–2010

Mathematical Optimization Society (MOS)	2010–
Operations Research Society of America (ORSA)	1985–1994
Sigma Xi	2005–
Society for Industrial and Applied Mathematics (SIAM)	1990–

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## BOOKS

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1. E.Çınlar and R.J. Vanderbei. *Real and Convex Analysis*. Springer, 2013.
2. J.R. Gott and R.J. Vanderbei. *Sizing Up The Universe: The Cosmos In Perspective*. National Geographic, 2010.
3. R.J. Vanderbei. *Linear Programming: Foundations and Extensions*. Springer (formerly Kluwer), (1st edition) 1997, (paperback) 1998, (2nd edition) 2001, (3rd edition) 2007, (4th edition) 2013, (5th edition) 2020.
4. N.D. Tyson, J.R. Gott, M.A. Strauss, and R.J. Vanderbei. *Welcome to the Universe in 3D*. Princeton University Press, 2021. To appear.

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## MOST CITED PUBLICATIONS

(AS OF JANUARY 2020)

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1. R.J. Vanderbei. *Linear Programming: Foundations and Extensions*. Springer, 4th edition, 2013.
2. J.M. Mulvey, R.J. Vanderbei, and S.A. Zenios. Robust optimization of large scale systems. *Operations Research*, 43(2):264–281, 1995.
3. C. Helmberg, F. Rendl, R.J. Vanderbei, and H. Wolkowicz. An interior point method for semidefinite programming. *SIAM Journal on Optimization*, 6:342–361, 1996.
4. R.J. Vanderbei. LOQO: An interior point code for quadratic programming. *Optimization Methods and Software*, 12:451–484, 1999.
5. R.J. Vanderbei and D.F. Shanno. An interior-point algorithm for nonconvex nonlinear programming. *Computational Optimization and Applications*, 13:231–252, 1999.
6. R.J. Vanderbei, M.S. Meketon, and B.F. Freedman. A modification of Karmarkar's linear programming algorithm. *Algorithmica*, 1:395–407, 1986.
7. R.J. Vanderbei. Symmetric quasi-definite matrices. *SIAM Journal on Optimization*, 5(1):100–113, 1995.
8. N.J. Kasdin, R.J. Vanderbei, D.N. Spergel, and M.G. Littman. Extrasolar planet finding via optimal apodized and shaped pupil coronagraphs. *Astrophysical Journal*, 582:1147–1161, 2003.
9. R.J. Vanderbei and T.J. Carpenter. Symmetric indefinite systems for interior-point methods. *Mathematical Programming*, 58:1–32, 1993.
10. H.Y. Benson, D.F. Shanno, and R.J. Vanderbei. Interior-Point Methods for Nonconvex Nonlinear Programming: Filter Methods and Merit Functions. *Computational Optimization and Applications*, 23:257–272, 2002.
11. D.F. Shanno and R.J. Vanderbei. Interior-Point Methods for Nonconvex Nonlinear Programming: Orderings and Higher-Order Methods. *Math. Prog.*, 87(2):303–316, 2000.

12. R.J. Vanderbei, D.N. Spergel, and N.J. Kasdin. Circularly Symmetric Apodization via Starshaped Masks. *Astrophysical Journal*, 599:686–694, 2003.
13. R.J. Vanderbei. LOQO user’s manual—version 3.10. *Optimization Methods and Software*, 12:485–514, 1999.
14. R. Soummer, L. Pueyo, A. Sivaramakrishnan, and R.J. Vanderbei. Fast computation of lyot-style coronagraph propagation. *Optics Express*, 15(24):15935–15951, 2007.
15. R.J. Vanderbei and J.C. Lagarias. I.I. Dikin’s convergence result for the affine-scaling algorithm. In *Contemporary Math.* AMS, 1990.
16. R.J. Vanderbei, D.N. Spergel, and N.J. Kasdin. Spiderweb Masks for High Contrast Imaging. *Astrophysical Journal*, 590:593–603, 2003.
17. L.A. Shepp and R.J. Vanderbei. The complex zeros of random polynomials. *Transactions of the AMS*, 347(11):4365–4384, 1995.
18. R.J. Vanderbei, E. Cady, and N.J. Kasdin. Optimal occulter design for finding extrasolar planets. *Astrophysical Journal*, 665(1):794–798, 2007.
19. A. Ruszczyński and R.J. Vanderbei. Frontiers of Stochastically Nondominated Portfolios. *Econometrica*, 71(4):1287–1297, 2003.
20. P. Fishburn, P. Schwander, L.A. Shepp, and R.J. Vanderbei. The discrete Radon transform and its approximate inversion via linear programming. *Disc. Appl. Math.*, 75:39–61, 1997.

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REFEREED JOURNAL PUBLICATIONS

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Number of singly-authored: 31

1. R.J. Vanderbei. Comments on: Distance Geometry and Data Science. *TOP Spanish Society of Statistics and Operations Research*, 28(2):1 – 3, 2020.
2. H. Sun, N.J. Kasdin, and R.J. Vanderbei. Efficient wavefront sensing for space-based adaptive optics. *Journal of Astronomical Telescopes, Instruments, and Systems*, 6(1):1 – 13, 2020.
3. E. Naghib, P. Yoachim, R.J. Vanderbei, A.J. Connolly, and R.L. Jones. A Framework for Telescope Schedulers: With Applications to the Large Synoptic Survey Telescope. *The Astronomical Journal*, 157(4):151, Apr 2019.
4. R.J. Vanderbei. Sparsity matters. *INFORMS OS Today*, 8(1):10–16, 2018.
5. He Sun, N.J. Kasdin, and R.J. Vanderbei. Identification and adaptive control of a high-contrast focal plane wavefront correction system. *J. Astron. Telesc. Instrum. Syst.*, 4(4):049006, 2018.
6. Haotian Pang, Han Liu, R.J. Vanderbei, and Tuo Zhao. Parametric Simplex Method for Sparse Learning. In I. Guyon et al., editor, *Advances in Neural Information Processing Systems 30*, pages 188–197. Curran Associates, Inc., 2017.
7. R.J. Vanderbei. The falling slinky. *American Mathematical Monthly*, 124(1):24–36, 2017.
8. B. Rudloff, F. Ulus, and R.J. Vanderbei. A parametric simplex algorithm for linear vector optimization problems. *Mathematical Programming, Series A*, 163(1):213–242, 2017.
9. D. Sirbu, Y. Kim, N.J. Kasdin, and R.J. Vanderbei. Diffraction-based sensitivity analysis for an external occulter laboratory demonstration. *Applied Optics*, 55(22):6083–6094, 2016.

10. N.T. Zimmerman, A.J. Riggs, N.J. Kasdin, A. Carlotti, and R.J. Vanderbei. Shaped Pupil Lyot Coronagraphs: High-Contrast Solutions for Restricted Focal Planes. *J. Astronomical Telescopes, Instruments, and Systems*, 2(1):1–21, 2016.
11. R.J. Vanderbei, K. Lin, H. Liu, and L. Wang. Revisiting Compressed Sensing: Exploiting the Efficiency of Simplex and Sparsification Methods. *Math. Prog. C*, 8:253–269, 2016.
12. R.J. Vanderbei. Alternative hypotheses for making the moon. *Physics Today*, 68(4):8–8, 2015.
13. C.L. Mallows and R.J. Vanderbei. Which Young Tableaux can represent an outer sum? *Journal of Integer Sequences*, 18, 2015.
14. F. Georget, J.H. Prévost, and R.J. Vanderbei. A Speciation Solver for Cement Paste Modeling and the Semismooth Newton Method. *Cement and Concrete Research*, 68:139–147, 2015.
15. Haotian Pang, Han Liu, and R.J. Vanderbei. The fastclime Package for Linear Programming and Large-Scale Precision Matrix Estimation in R. *JMLR*, 15(1):489–493, 2014.
16. R.J. Vanderbei, G. Scharf, and D. Marlow. A Regression Approach to Fairer Grading. *SIAM Review*, 56(2):337–352, 2014.
17. D. Sirbu, N.J. Kasdin, and R.J. Vanderbei. Monochromatic verification of high-contrast imaging with an occulter. *Optics Express*, 21(26):32234–32253, Dec 2013.
18. R.J. Vanderbei, M.Ç. Pinar, and E.F. Bozkaya. Discrete-Time Pricing and Optimal Exercise of American Perpetual Warrants in the Geometric Random Walk Model. *Applied Mathematics and Optimization*, 67:97–122, 2013.
19. R. J. Vanderbei. Fast Fourier optimization. *Math. Prog. Comp.*, 4(1):53–69, 2012.
20. R.J. Vanderbei. Local Warming. *SIAM Review*, 54(3):597–606, 2012.
21. A. Carlotti, R. J. Vanderbei, and N. J. Kasdin. Optimal pupil apodizations for arbitrary apertures. *Optics Express*, 19(27):26796–26809, 2011.
22. L. Pueyo, N.J. Kasdin, A. Carlotti, and R. J. Vanderbei. Design of phase induced amplitude apodization coronagraphs over square apertures. *The Astrophysical Journal*, 195(2):25, 2011.
23. R.J. Vanderbei. Sequencing the stars. *Sky and Telescope*, 116(11):30–34, 2010.
24. N.J. Kasdin, D.N. Spergel, R.J. Vanderbei, E. Cady, D. Savransky, D. Lisman, S. Shaklan, R. Lee, R. Egerman, G. Matthews, and D. Tenerelli. A medium size mission for finding and characterizing terrestrial exoplanets with an external occulter and a conventional telescope. *Bull. AAS*, 42:287, 2010.
25. R.J. Vanderbei and M.Ç. Pinar. Pricing American Perpetual Warrants by Linear Programming. *SIAM Review*, 51:767–782, 2009.
26. J. N. Winn, A. W. Howard, J. A. Johnson, G. W. Marcy, J. Z. Gazak, D. Starkey, E. B. Ford, K. D. Colón, F. Reyes, L. Nortmann, S. Dreizler, S. Odewahn, W. F. Welsh, S. Kadakia, R. J. Vanderbei, E. R. Adams, M. Lockhart, I. J. Crossfield, J. A. Valenti, R. Dantowitz, and J. A. Carter. The Transit Ingress and the Tilted Orbit of the Extraordinarily Eccentric Exoplanet HD 80606b. *The Astrophysical Journal*, 703:2091–2100, October 2009.
27. R.J. Vanderbei. Eliminating poisson’s spot with linear programming. In J.W. Chinneck, B. Kristjansson, and M. Saltzman, editors, *Operations Research and Cyber-Infrastructure*. Springer, 2009.
28. K. Yetilmezsoy, S. Demirel, and R.J. Vanderbei. Response surface modeling of Pb(II) removal from aqueous solution by Pistacia vera l.: Box-Behnken experimental design. *J. of Hazardous Materials*, 171:551–562, 2009.



29. J.C. Lagarias, E. Rains, and R.J. Vanderbei. The Kruskal Count. In S. Brams et al., editor, *The Mathematics of Preference, Choice, and Order: Essays in Honor of Peter C. Fishburn*. Springer-Verlag, 2009.
30. R.J. Vanderbei. The Earth Is Not Flat: An Analysis of a Sunset Photo. *Optics and Photonics News*, November:34–39, 2008.
31. R.J. Vanderbei. Linear Stability of Ring Systems Around Oblate Central Masses. *Advances in Space Research*, 42:1370–1377, 2008.
32. R.J. Vanderbei. Extreme Optics and the Search for Earth-Like Planets. *Mathematical Programming Series B*, 112(1):255–272, 2008.
33. I. Griva, D.F. Shanno, R.J. Vanderbei, and H.Y. Benson. Global convergence of a primal-dual interior-point method for nonlinear programming. *Algorithmic Operations Research*, 3(1):12–19, 2008.
34. N. J. Kasdin, R. J. Vanderbei, and R. Belikov. Shaped pupil coronagraphy. *Comptes Rendus Physique*, 8:312–322, April 2007.
35. R.J. Vanderbei, E. Cady, and N.J. Kasdin. Optimal occulter design for finding extra-solar planets. *Astrophysical Journal*, 665(1):794–798, 2007.
36. N.J. Kasdin, R.J. Vanderbei, and R. Belikov. Shaped pupil coronagraphy. *C.R. Physique*, 8:312–322, 2007.
37. R.J. Vanderbei and R. Belikov. Measuring the astronomical unit from your backyard. *Sky and Telescope*, 113(1):91–94, 2007.
38. R.J. Vanderbei. A Simple Approximate Analysis of the Linear Stability of Ring Systems. In *New Trends in Astrodynamics and Applications III*, volume 886, pages 169–174. American Institute of Physics, 2007.
39. R.J. Vanderbei and E. Kolemen. Linear Stability of Ring Systems. *Astronomical Journal*, 133(2):656–664, 2007.
40. R. Soummer, L. Pueyo, A. Sivaramakrishnan, and R.J. Vanderbei. Fast computation of lyot-style coronagraph propagation. *Optics Express*, 15(24):15935–15951, 2007.
41. H.Y. Benson, A. Sen, D.F. Shanno, and R.J. Vanderbei. Interior-point algorithms, penalty methods and equilibrium problems. *Comp. Opt. and Appl.*, 34:155–182, 2006.
42. R. Belikov, N.J. Kasdin, and R.J. Vanderbei. Diffraction-Based Sensitivity Analysis of Apodized Pupil Mapping Systems. *Astrophysical Journal*, 652:833, 2006.
43. Give'on A., Kasdin N. J., Vanderbei R. J., and Avitzour Y. On representing and correcting wavefront errors in high-contrast imaging systems. *Journal of the Optical Society of America A*, 23, May 2006.
44. R.J. Vanderbei. Diffraction Analysis of 2-D Pupil Mapping for High-Contrast Imaging. *Astrophysical Journal*, 636:528, 2006.
45. R.J. Vanderbei. Horsing Around on Saturn. In *New Trends in Astrodynamics and Applications*, volume 1065, pages 336–345. NY Academy of Sciences, 2005.
46. I. Griva and R.J. Vanderbei. Case Studies in Trajectory Optimization: Catenary Problem. *Optimization and Engineering*, 6:463–482, 2005.
47. R.J. Vanderbei and W.A. Traub. Pupil Mapping in 2-D for High-Contrast Imaging. *Astrophysical Journal*, 626:1079–1090, 2005.
48. N.J. Kasdin, R.J. Vanderbei, M.G. Littman, and D.N. Spergel. Optimal one-dimensional apodizations and shaped pupils for planet finding coronagraphy. *Applied Optics*, 44(7):1117–1128, 2005.
49. N. J. Kasdin, R. J. Vanderbei, M. G. Littman, D. Ren, M. Carr, and D. N. Spergel. Optimal Designs, Mask Manufacture, and Experimental Results for Shaped Pupil Coronagraphs. *Bulletin of the American Astronomical Society*, 205:514–+, December 2004.

50. A. Giveón, N. J. Kasdin, M. G. Littman, L. A. Pueyo, and R. J. Vanderbei. Adaptive Optics for High-Contrast Imaging. *Bulletin of the American Astronomical Society*, 205:515–+, December 2004.
51. N.J. Kasdin, R.A. Brown, C.J. Burrows, S. Kilston, M. Kuchner, M.G. Littman, M.C. Noecker, S. Seager, R. J. Vanderbei, and R.A. Woodruff. An optical/UV space coronagraph concept for the terrestrial planet finder. *Advances in Space Research*, 34(3):625–630, 2004.
52. R. J. Vanderbei, N. J. Kasdin, and D. N. Spergel. Checkerboard-Mask Coronagraphs for High-Contrast Imaging. *Astrophysical Journal*, 615(1):555, 2004.
53. H.Y. Benson, D.F. Shanno, and R.J. Vanderbei. Interior-Point Methods for Nonconvex Nonlinear Programming: Jamming and Numerical Testing. *Mathematical Programming*, 99(1):35–48, 2004.
54. W.A. Traub and R.J. Vanderbei. Two-Mirror Apodization for High-Contrast Imaging. *Astrophysical Journal*, 599:695–701, 2003.
55. R.J. Vanderbei, D.N. Spergel, and N.J. Kasdin. Circularly Symmetric Apodization via Starshaped Masks. *Astrophysical Journal*, 599:686–694, 2003.
56. W. Simmons, N.J. Kasdin, R.J. Vanderbei, and W. Cash. System concept design for the new worlds observer. *Bulletin of the American Astronomical Society*, 35:1205, 2003.
57. R.J. Vanderbei, D.N. Spergel, and N.J. Kasdin. Spiderweb Masks for High Contrast Imaging. *Astrophysical Journal*, 590:593–603, 2003.
58. A. Ruszczyński and R.J. Vanderbei. Frontiers of Stochastically Nondominated Portfolios. *Econometrica*, 71(4):1287–1297, 2003.
59. R.J. Vanderbei and H.Y. Benson. Solving Problems with Semidefinite and Related Constraints Using Interior-Point Methods for Nonlinear Programming. *Mathematical Programming*, 95:279–302, 2003.
60. N.J. Kasdin, R.J. Vanderbei, D.N. Spergel, and M.G. Littman. Extrasolar Planet Finding via Optimal Apodized and Shaped Pupil Coronagraphs. *Astrophysical Journal*, 582:1147–1161, 2003.
61. H.Y. Benson, D.F. Shanno, and R.J. Vanderbei. Interior-Point Methods for Nonconvex Nonlinear Programming: Filter Methods and Merit Functions. *Computational Optimization and Applications*, 23:257–272, 2002.
62. S. Kruk, M. Muramatsu, R. Rendl, R.J. Vanderbei, and H. Wolkowicz. The Gauss-Newton Direction in Semidefinite Programming. *Optimization Methods and Software*, 15(1):1–27, 2001.
63. R.J. Vanderbei. Case Studies in Trajectory Optimization: Trains, Planes, and Other Pastimes. *Optimization and Engineering*, 2:215–243, 2001.
64. D.F. Shanno and R.J. Vanderbei. Interior-Point Methods for Nonconvex Nonlinear Programming: Orderings and Higher-Order Methods. *Math. Prog.*, 87(2):303–316, 2000.
65. R.J. Vanderbei. LOQO: An interior point code for quadratic programming. *Optimization Methods and Software*, 12:451–484, 1999.
66. R.J. Vanderbei. LOQO User’s Manual—Version 3.10. *Optimization Methods and Software*, 12:485–514, 1999.
67. R.J. Vanderbei and D.F. Shanno. An Interior-Point Algorithm for Nonconvex Nonlinear Programming. *Computational Optimization and Applications*, 13:231–252, 1999.
68. R.J. Vanderbei. Extension of Piyavskii’s Algorithm to Continuous Global Optimization. *J. Global Opt.*, 14:205–216, 1999.
69. M. Muramatsu and R.J. Vanderbei. Primal-Dual Affine-Scaling Algorithms Fail for Semidefinite Programming. *Mathematics of Operations Research*, 24(1):149–175,

- 1999.
70. A. Kagan, C. Mallows, L.A. Shepp, R.J. Vanderbei, and Y. Vardi. Symmetrization of Binary Random Variables. *Bernoulli*, 5(6):1013–1020, 1999.
  71. P. Fishburn, P. Schwander, L.A. Shepp, and R.J. Vanderbei. The discrete Radon transform and its approximate inversion via linear programming. *Disc. Appl. Math.*, 75:39–61, 1997.
  72. A.J. Berger, J.M. Mulvey, E. Rothberg, and R.J. Vanderbei. Solving multistage stochastic programs using tree dissection. *SIAM Journal on Optimization*, 1996. To appear.
  73. C. Helmberg, F. Rendl, R.J. Vanderbei, and H. Wolkowicz. An interior point method for semidefinite programming. *SIAM Journal on Optimization*, 6:342–361, 1996.
  74. J.M. Mulvey, R.J. Vanderbei, and S.A. Zenios. Robust optimization of large scale systems. *Operations Research*, 43(2):264–281, 1995.
  75. F. Rendl, R.J. Vanderbei, and H. Wolkowicz. Max-min eigenvalue problems, primal-dual interior point algorithms, and trust region subproblems. *Optimization Methods and Software*, 5:1–16, 1995.
  76. R.J. Vanderbei. A probabilistic formula for the concave hull of a function. *Ann. Prob.*, 23:2014–2021, 1995.
  77. L.A. Shepp and R.J. Vanderbei. The complex zeros of random polynomials. *Transactions of the AMS*, 347(11):4365–4384, 1995.
  78. R.J. Vanderbei and B. Yang. The simplest semidefinite programs are trivial. *Math. of OR*, 20:590–596, 1995.
  79. R.J. Vanderbei. Affine-scaling trajectories associated with a semi-infinite linear program. *Math. of OR*, 20:163–174, 1995.
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## TECHNICAL REPORTS

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2. Haotian Pang, Tuo Zhao, R.J. Vanderbei, and Han Liu. A Parametric Simplex Approach to Statistical Learning Problems. Technical report, Princeton University, 2015.
3. R.J. Vanderbei. Linear Stability of Lagrange Points: Complex Variable Notation. Technical report, Department of Operations Research and Financial Engineering, Princeton Univ., 2006.
4. R.J. Vanderbei. Lagrange Points for Eccentric Planar 3-Body Systems . Technical report, Department of Operations Research and Financial Engineering, Princeton University, 2006.
5. H.Y. Benson, D.F. Shanno, and R.J. Vanderbei. A Comparative Study of Large-Scale Nonlinear Optimization Algorithms. Technical Report ORFE 01-04, Department of Operations Research and Financial Engineering, Princeton University, 2001.
6. R.J. Vanderbei and H. Yurttan. Using LOQO to Solve Second-Order Cone Programming Problems. Technical Report SOR-98-09, Statistics and Operations Research, Princeton University, 1998. Submitted *Optimization and Engineering*.
7. R.J. Vanderbei and J. Iannone. An EM approach to OD matrix estimation. Technical Report SOR 94-04, Princeton University, 1994.
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9. A. Duarte and R.J. Vanderbei. A computational analysis of quasi-definite systems in interior-point algorithms. Technical Report SOR 94-11, Princeton University, 1994.
10. A. Duarte and R.J. Vanderbei. Interior point algorithms for LSAD and LMAD estimation. Technical Report SOR 94-07, Princeton University, 1994.
11. R.J. Vanderbei. Constructing strong markov processes. Technical report, University of Illinois, 1984.

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## BOOK REVIEWS & ENCYCLOPEDIA ENTRIES

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1. R.J. Vanderbei. Linear programming. In *Encyclopedia of Applied and Computational Mathematics*, pages 742–745. Springer–Verlag, 2015.
2. R.J. Vanderbei. Review of Linear Programming, a Modern Integrated Analysis by R. Saigal. *Interfaces*, 27:120–122, 1997.

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## PATENTS

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1. R.J. Vanderbei. Methods and apparatus for efficient resource allocation, May 1988. U.S. Patent Number 4,744,026. Extension of Karmarkar algorithm to handle linear programming problems with free variables.
2. R.J. Vanderbei. Methods and apparatus for efficient resource allocation, Dec 1989. U.S. Patent Number 4,885,686. Extension of Karmarkar algorithm to handle linear programming problems with dense columns.

3. B.A. Freedman, M.S. Meketon, and R.J. Vanderbei. Methods and apparatus for efficient resource allocation, May 1990. U.S. Patent Number 4,924,386. Extension of Karmarkar algorithm to handle linear programming problems with nonzero lower bounds and finite upper bounds.
4. P. Schwander, L.A. Shepp, and R.J. Vanderbei. Apparatus and method for tomography of microscopic samples, August 1997. U.S. Patent Number 5,659,175. Invention concerns microscopic tomography, wherein probabilities of occupancy of individual lattice sites within a crystal are estimated. Application to the examination of the internal structure of semiconductors.

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## ON-LINE EDUCATIONAL RESOURCES

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Pivot tools for teaching linear programming:

<https://vanderbei.princeton.edu/JAVA/pivot/simple.html>

<https://vanderbei.princeton.edu/JAVA/network/nettool/netsimp.html>.

A case study using sailing as a metaphor for the stochastic optimization.

<https://vanderbei.princeton.edu/JAVA/sail/sail.html>.

Java applets illustrating interesting solutions to the n-body problem (several are obtained as the solution to an optimization problem):

<https://vanderbei.princeton.edu/JAVA/astro/galaxy/nBody.html>.

WebGL applets illustrating interesting solutions to the n-body problem (several are obtained as the solution to an optimization problem):

<https://vanderbei.princeton.edu/WebGL/ducati.html>.

A case study illustrating how optimization is used to design FIR filters:

<https://vanderbei.princeton.edu/floyd.html>

Applets illustrating linear programming algorithms in the context of solving the minimum weight structural design problem:

[https://vanderbei.princeton.edu/JAVA/twophase\\_animate](https://vanderbei.princeton.edu/JAVA/twophase_animate),

[https://vanderbei.princeton.edu/JAVA/pd\\_animate2](https://vanderbei.princeton.edu/JAVA/pd_animate2),

[https://vanderbei.princeton.edu/JAVA/affine\\_animate2](https://vanderbei.princeton.edu/JAVA/affine_animate2)

WebGL 3D models of various minimal surfaces:

<https://vanderbei.princeton.edu/WebGL/minsurf.html>

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## GRADUATE STUDENTS ADVISED/CO-ADVISED

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Antonio Marcos Duarte Júnior	Ph.D. 1993
Bing Yang	Ph.D. 1996
Jianhua Yuan	M.A. 1996
Hande Yurttan Benson	Ph.D. 2001
Arun Sen	Ph.D. 2005
Amir Give' on	Ph.D. 2006
Egemen Kolemen	Ph.D. 2008
Laurent Pueyo	Ph.D. 2008



Eric Cady	Ph.D. 2010
Dmitry Savransky	Ph.D. 2011
Tyler Groff	Ph.D. 2013
Dan Sirbu	Ph.D. 2014
Ethan Fang	Ph.D. 2016
Haotian Pang	Ph.D. 2017
Hari Subedi	Ph.D. 2018
Elahe Naghib	Ph.D. 2019
He Sun	Ph.D. 2019
Joane Joseph	Ph.D. 2020

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## COURSES TAUGHT

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### *Princeton*

Sizing Up the Universe	FRS 131, 175
Computer Methods for Problem Solving	ORF 201
Fundamentals of Statistics	ORF 245
Optimization	ORF 307
Stochastic Systems Analysis	CIV 308
Real Analysis for Engineers	CIV 506
Stochastic Processes	ORF 515
Linear and Convex Optimization	ORF 522
Nonlinear Programming	ORF 523
Convex Analysis	ORF 569

### *University of Illinois*

Calculus II	MATH 130
Probability	MATH 361
Probability and Statistics	MATH 363
Applied Stochastic Processes	MATH 461

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## DEVELOPMENT EXPERIENCE

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**KORBX:** Lead architect and developer of AT&T's commercial implementation of the affine-scaling algorithm for linear programming.

**LOQO:** A software package for general nonlinear optimization.

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**OUTSIDE ACTIVITIES**

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*Soaring*

<b>Private Pilot</b>	1979–
<b>Commercial Pilot</b>	1983–
<b>Certificated Flight Instructor (CFI)</b>	1983–1999
<b>Chief Flight Instructor, Central Jersey Soaring Club</b>	1987–1996

*Skiing*

<b>National Ski Patrol</b>	1972–1974
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