Stanford



Michael Saunders

Professor (Research) of Management Science and Engineering, Emeritus

Curriculum Vitae available Online

Bio

BIO

Saunders develops mathematical methods for solving large-scale constrained optimization problems and large systems of equations. He also implements such methods as general-purpose software to allow their use in many areas of engineering, science, and business. He is co-developer of the large-scale optimizers MINOS, SNOPT, SQOPT, PDCO, the dense QP and NLP solvers LSSOL, QPOPT, NPSOL, and the linear equation solvers SYMMLQ, MINRES, MINRES-QLP, LSQR, LSMR, LSLQ, LNLQ, LSRN, LUSOL.

ACADEMIC APPOINTMENTS

- Emeritus Faculty, Acad Council, Management Science and Engineering
- Member, Institute for Computational and Mathematical Engineering (ICME)

HONORS AND AWARDS

- Orchard-Hays Prize, MPS (1985)
- Highly Cited Researcher, Computer Science, ISI (2004)
- Highly Cited Researcher, Mathematics, ISI (2007)
- Honorary Fellow, RSNZ (2007)
- Linear Algebra Prize, SIAM (2012)
- Invention Hall of Fame, OTL, Stanford University (2012)
- Fellow, SIAM (2013)

BOARDS, ADVISORY COMMITTEES, PROFESSIONAL ORGANIZATIONS

- Associate Editor, NACO (2010 - 2016)
- Member, ACM (1982 - present)
- Member, INFORMS (2010 - present)
- Member, ORSNZ (1990 - present)
- Member, SIAM (1980 - present)
- Associate Editor, ACM TOMS (1982 - 2004)
- Associate Editor, SIAM Journal on Optimization (1989 - 2002)
- Associate Editor, OPTE (1999 - present)

PROFESSIONAL EDUCATION

- B.Sc. (Hons), Canterbury , Mathematics (1965)
- MS, Stanford University , Computer Science (1970)
- PhD, Stanford University , Computer Science (1972)

LINKS

- My homepage: http://stanford.edu/~saunders/
- My lab site: http://stanford.edu/group/SOL
- Where my office and students are (most of them): http://icme.stanford.edu/
- Homepage for our DOE and NIH grants: http://stanford.edu/group/SOL/multiscale/

Teaching

COURSES

2026-27

- Linear Algebra and Optimization Seminar: CME 510 (Win)

2025-26

- Linear Algebra and Optimization Seminar: CME 510 (Win)

2024-25

- Linear Algebra and Optimization Seminar: CME 510 (Win)

Publications

PUBLICATIONS

- **IMPLEMENTING A SMOOTH EXACT PENALTY FUNCTION FOR EQUALITY-CONSTRAINED NONLINEAR OPTIMIZATION** *SIAM JOURNAL ON SCIENTIFIC COMPUTING*
  Estrin, R., Friedlander, M. P., Orban, D., Saunders, M. A.
  2020; 42 (3): A1809–A1835
- **IMPLEMENTING A SMOOTH EXACT PENALTY FUNCTION FOR GENERAL CONSTRAINED NONLINEAR OPTIMIZATION** *SIAM JOURNAL ON SCIENTIFIC COMPUTING*
  Estrin, R., Friedlander, M. P., Orban, D., Saunders, M. A.
  2020; 42 (3): A1836–A1859
- **Analysis of the Regularization Parameters of Primal-Dual Interior Method for Convex Objectives Applied to H-1 Low Field Nuclear Magnetic Resonance Data Processing (vol 49, pg 1129, 2018)** *APPLIED MAGNETIC RESONANCE*
  Campisi-Pinto, S., Levi, O., Benson, D., Cohen, M., Resende, M., Saunders, M., Linder, C., Wiesman, Z.
  2019; 50 (1-3): 521
- **EUCLIDEAN-NORM ERROR BOUNDS FOR SYMMLQ AND CG** *SIAM JOURNAL ON MATRIX ANALYSIS AND APPLICATIONS*
  Estrin, R., Orban, D., Saunders, M.
  2019; 40 (1): 235–53
- **LSLQ: AN ITERATIVE METHOD FOR LINEAR LEAST-SQUARES WITH AN ERROR MINIMIZATION PROPERTY** *SIAM JOURNAL ON MATRIX ANALYSIS AND APPLICATIONS*
  Estrin, R., Orban, D., Saunders, M. A.
  2019; 40 (1): 254–75
- **Stabilized Optimization Via an NCL Algorithm**
  Ma, D., Judd, K. L., Orban, D., Saunders, M. A.
  edited by AlBaali, M., Grandinetti, L., Purnama, A.

SPRINGER.2018: 173–91

- **Reliable and efficient solution of genome-scale models of Metabolism and macromolecular Expression** *SCIENTIFIC REPORTS*
  Ma, D., Yang, L., Fleming, R. M., Thiele, I., Palsson, B. O., Saunders, M. A.
  2017; 7
- **Conditions for duality between fluxes and concentrations in biochemical networks** *JOURNAL OF THEORETICAL BIOLOGY*
  Fleming, R. M., Vlassis, N., Thiele, I., Saunders, M. A.
  2016; 409: 1-10
- **Laplace inversion of low-resolution NMR relaxometry data using sparse representation methods** *Concepts in Magnetic Resonance Part A*
  Berman, P., Levi, O., Parmet, Y., Saunders, M., Wiesman, Z.
  2013; 42A:3: 72-88
- **Novel 1H low field nuclear magnetic resonance applications for the field of biodiesel** *Biotechnologyfor Biofuels*
  Berman, P., Leshem, A., Etziony, O., Levi, O., Parmet, Y., Saunders, M., Wiesman, Z.
  2013; 6:55: 20
- **LSRN: a parallel iterative solver for strongly over- or under-determined systems** *SIAM J. Sci. Comp.*
  Meng, X., Saunders, M. A., Mahoney, M. W.
  2013; 36 (2): C95-C118
- **A variational principle for computing nonequilibrium fluxes and potentials in genome-scale biochemical networks** *JOURNAL OF THEORETICAL BIOLOGY*
  Fleming, R. M., MAES, C. M., Saunders, M. A., Ye, Y., Palsson, B. O.
  2012; 292: 71-77
- **LSMR: AN ITERATIVE ALGORITHM FOR SPARSE LEAST-SQUARES PROBLEMS** *SIAM JOURNAL ON SCIENTIFIC COMPUTING*
  Fong, D. C., Saunders, M.
  2011; 33 (5): 2950-2971
- **SNOPT: An SQP algorithm for large-scaleconstrained optimization, SIGEST article** *SIAM Rev.*
  Gill, P., E., Murray, W., Saunders, M., A.
  2005; 1 (47): 99-131
- **Atomic decomposition by basis pursuit, SIGEST article** *SIAM Rev.*
  Chen, S., S., Donoho, D., L., Saunders, M., A.
  2001; 1 (43): 129-159
- **Properties of semi-conjugate gradient methods for solving unsymmetric positive definite linear systems** *OPTIMIZATION METHODS & SOFTWARE*
  Huang, N., Dai, Y., Orban, D., Saunders, M. A.
  2023
- **HyKKT: a hybrid direct-iterative method for solving KKT linear systems** *OPTIMIZATION METHODS & SOFTWARE*
  Regev, S., Chiang, N., Darve, E., Petra, C. G., Saunders, M. A., Swirydowicz, K., Peles, S.
  2022
- **Linear solvers for power grid optimization problems: A review of GPU-accelerated linear solvers** *PARALLEL COMPUTING*
  Swirydowicz, K., Darve, E., Jones, W., Maack, J., Regev, S., Saunders, M. A., Thomas, S. J., Peles, S.
  2022; 111
- **LARGE-SCALE OPTIMIZATION WITH LINEAR EQUALITY CONSTRAINTS USING REDUCED COMPACT REPRESENTATION\ast** *SIAM JOURNAL ON SCIENTIFIC COMPUTING*
  Brust, J. J., Marcia, R. F., Petra, C. G., Saunders, M. A.
  2022; 44 (1): A103-A127
- **Linear systems arising in interior methods for convex optimization: a symmetric formulation with bounded condition number** *OPTIMIZATION METHODS & SOFTWARE*
  Ghannad, A., Orban, D., Saunders, M. A.
  2021

- **Simulation-Based Sensitivity Analysis of Regularization Parameters for Robust Reconstruction of Complex Material's T-1 - (T2H)-H-1 LF-NMR Energy Relaxation Signals** *APPLIED MAGNETIC RESONANCE*
  Campisi-Pinto, S., Levi, O., Benson, D., Resende, M., Saunders, M., Linder, C., Wiesman, Z.
  2019
- **Creation and analysis of biochemical constraint-based models using the COBRA Toolbox v.3.0.** *Nature protocols*
  Heirendt, L., Arreckx, S., Pfau, T., Mendoza, S. N., Richelle, A., Heinken, A., Haraldsdottir, H. S., Wachowiak, J., Keating, S. M., Vlasov, V., Magnusdottir, S., Ng, C. Y., Preciat, et al
  2019
- **DynamicME: dynamic simulation and refinement of integrated models of metabolism and protein expression.** *BMC systems biology*
  Yang, L., Ebrahim, A., Lloyd, C. J., Saunders, M. A., Palsson, B. O.
  2019; 13 (1): 2
- **LNLQ: AN ITERATIVE METHOD FOR LEAST-NORM PROBLEMS WITH AN ERROR MINIMIZATION PROPERTY** *SIAM JOURNAL ON MATRIX ANALYSIS AND APPLICATIONS*
  Estrin, R., Orban, D., Saunders, M. A.
  2019; 40 (3): 1102–24
- **Estimating Cellular Goals from High-Dimensional Biological Data**
  Yang, L., Saunders, M. A., Lachance, J., Palsson, B. O., Bento, J., Assoc Comp Machinery
  ASSOC COMPUTING MACHINERY.2019: 2202–11
- **Analysis of the Regularization Parameters of Primal-Dual Interior Method for Convex Objectives Applied to H-1 Low Field Nuclear Magnetic Resonance Data Processing** *APPLIED MAGNETIC RESONANCE*
  Campisi-Pinto, S., Levi, O., Benson, D., Cohen, M., Resende, M., Saunders, M., Linder, C., Wiesman, Z.
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  Yang, L., Yurkovich, J. T., Lloyd, C. J., Ebrahim, A., Saunders, M. A., Palsson, B. O.
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  Yang, L., Ma, D., Ebrahim, A., Lloyd, C. J., Saunders, M. A., Palsson, B. O.
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- **Study of liquid-phase molecular packing interactions and morphology of fatty acid methyl esters (biodiesel).** *Biotechnology for biofuels*
  Berman, P., Meiri, N., Colnago, L. A., Moraes, T. B., Linder, C., Levi, O., Parmet, Y., Saunders, M., Wiesman, Z.

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- **Algorithm 937: MINRES-QLP for Symmetric and Hermitian Linear Equations and Least-Squares Problems.** *ACM transactions on mathematical software. Association for Computing Machinery*
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- **LSRN: A PARALLEL ITERATIVE SOLVER FOR STRONGLY OVER- OR UNDERDETERMINED SYSTEMS** *SIAM JOURNAL ON SCIENTIFIC COMPUTING*
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  Lee, J. D., Sun, Y., Saunders, M. A.
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- **Robust flux balance analysis of multiscale biochemical reaction networks** *BMC BIOINFORMATICS*
  Sun, Y., Fleming, R. M., Thiele, I., Saunders, M. A.
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- **SpaseLoc: An adaptive subproblem algorithm for scalable wireless sensor network localization** *SIAM JOURNAL ON OPTIMIZATION*
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  Fransson, C., M., Lennartson, B., Wik, T., Holmstrom, K., Saunders, M., Gutman, P., O.
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- **Atomic decomposition by basis pursuit** *SIAM REVIEW*
  Chen, S. S., Donoho, D. L., Saunders, M. A.
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1998

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