

List of Publications

- [1] E. W. Sachs. *Differenzierbarkeit in der Optimierungstheorie und Anwendung auf Kontrollprobleme*. Doktorarbeit, Technische Hochschule Darmstadt, 1975.
- [2] E. W. Sachs. Computation of Bang–Bang–controls and lower bounds for a parabolic boundary–value control problem. In W. Oettli and K. Ritter, editors, *Optimization and Operations Research, Oberwolfach 1975*, volume 117 of *Lect. Notes Econ. Math Systems*, pages 247–257. Springer, 1976.
- [3] E. W. Sachs. Computation of lower bounds of an optimal control problem via homogeneous programming. *Methods of Operations Research*, 25:406–414, 1977.
- [4] K. Glashoff and E. W. Sachs. On theoretical and numerical aspects of the bang–bang principle. *Numer. Math.*, 29:93–113, 1977.
- [5] E. Sachs. A parabolic control problem with a boundary condition of the Stefan-Boltzmann type. *Z. Angew. Math. Mech.*, 58:443–449, 1978.
- [6] B. Artmann, W. Peterhänsel, and E. W. Sachs. *Beispiele und Aufgaben zur Linearen Algebra*. Bibliographisches Institut, Mannheim-Wien-Zürich, 1978.
- [7] E. W. Sachs. Optimal control of a parabolic boundary value problem. In J. Stoer, editor, *Optimization Techniques, Proceed. of 8th IFIP Conf., Part I*, volume 6 of *Lect. Notes Control and Inform. Sc.*, pages 353–361. Springer, 1978.
- [8] E. W. Sachs. Optimal control of a class of integral equations. In B. Korte R. Henn and W. Oettli, editors, *Optimization and Operations Research, Proceed. Bonn 1977*, volume 157 of *Lect. Notes Econ. and Math. Systems*, pages 223–231. Springer, 1978.
- [9] E. W. Sachs. Nonstationary control of parabolic differential equations. *Methods of Operations Research*, 28:196–210, 1978.
- [10] E. W. Sachs. Differentiability in optimization theory. *Math. Operationsforsch. Statist., Ser. Optim.*, 9:497–513, 1978.
- [11] W. Krabs and E. W. Sachs. Controllability of distributed parameter systems. *Z. Angew. Math. Mech.*, 59:T103–T105, 1979.
- [12] E. W. Sachs. *Quasi-Newton Methoden in der Kontrolltheorie*. Habilitationsschrift, Technische Hochschule Darmstadt, 1980.
- [13] E. W. Sachs and G. Schmidt. On reachable states in boundary control for the heat equation, and an associated problem. *Appl. Math. Optimization*, 7:225–232, 1981.
- [14] R. Martin and E. W. Sachs. Positive control for quasimonotone systems of differential equations. *J. Math. Anal. Appl.*, 84:584–594, 1981.
- [15] W. A. Gruver and E. Sachs. *Algorithmic Methods In Optimal Control*. Pitman, London, 1980.
- [16] E. W. Sachs. Quasi-Newton methods for a class of nonsmooth constrained optimization problems. In *System Modelling and Optimization, Proceed. 10th IFIP Conf.*, volume 38 of *Lect. Notes Contr. and Inform. Sc.*, pages 548–556. Springer, 1982.

- [17] E. W. Sachs. An application of duality theory to control–approximation problems. *J. Approx. Theory*, 35:99–110, 1982.
- [18] E. W. Sachs. Optimal control problems in diffusion processes with a nonsmooth nonlinear boundary condition. *Math. Methods Appl. Sc.*, 5:117–130, 1983.
- [19] E. W. Sachs. Characterizations of Bang–Bang–principles. *Nonlinear Anal.*, 7:419–430, 1983.
- [20] E. Sachs. Global convergence of quasi-Newton-type algorithms for some nonsmooth optimization problems. *J. Optim. Theory Applic.*, 40:201–219, 1983.
- [21] J. C. Dunn and E. W. Sachs. The effect of perturbations on the convergence rates of optimization algorithms. *Appl. Math. Optimization*, 10:143–147, 1983.
- [22] E. W. Sachs. Newton’s method for singular constrained optimization problems. *Appl. Math. Optimization*, 11:247–276, 1984.
- [23] E. Sachs. Convergence rates of quasi-Newton methods for some nonsmooth optimization problems. *SIAM J. Control and Optimization*, 23:401–418, 1985.
- [24] C. T. Kelley and E. W. Sachs. Broyden’s method for approximate solution of nonlinear integral equations. *J. Integral Eqs.*, 9:25–44, 1985.
- [25] E. W. Sachs. Rates of convergence of adaptive Newton methods. *J. Optim. Theory Applic.*, 48:175–190, 1986.
- [26] J. Jahn and E. W. Sachs. Generalized convex mappings and vector optimization. *SIAM J. Control and Optimization*, 24:306–322, 1986.
- [27] E. Sachs. Broyden’s method in Hilbert space. *Math. Programming*, 35:71–82, 1986.
- [28] C. T. Kelley and E. W. Sachs. A quasi-Newton method for elliptic boundary value problems. *SIAM J. Numer. Anal.*, 24:516–531, 1987.
- [29] C. T. Kelley and E. W. Sachs. Quasi-Newton methods and unconstrained optimal control problems. *SIAM J. Control and Optimization*, 25:1503–1517, 1987.
- [30] C. T. Kelley and E. W. Sachs. Applications of quasi-Newton methods to pseudoparabolic control problems. In K.-H. Hoffmann and W. Krabs, editors, *Optimal Control of Partial Differential Equations II - Theory and Applications, May, 1986*, volume 78 of *Int. Series Num. Math.*, Basel, 1987. Birkhäuser.
- [31] C. T. Kelley and E. W. Sachs. A pointwise quasi-Newton method for unconstrained optimal control problems. *Numer. Math.*, 55:159–176, 1989.
- [32] M. Heinkenschloß and E. W. Sachs. The role of growth rates for GaußNewton methods and parameter identification problems. In A. El Jai and M. Amouroux, editors, *Fifth Symposium on Control of Distributed Parameter Systems*, pages 79–84, 1989.
- [33] C. T. Kelley and E. W. Sachs. Approximate quasi-Newton methods. *Mathematical Programming, ser. B*, 48:41–70, 1990.
- [34] E. W. Sachs. Convergence of algorithms for perturbed optimization problems. *Annals of Operations Research*, 27:311–342, 1990.
- [35] C. T. Kelley and E. W. Sachs. A new proof of superlinear convergence for Broyden’s method in Hilbert space. *SIAM J. Optimization*, 1:146–150, 1991.

- [36] C. T. Kelley and E. W. Sachs. Fast algorithms for compact fixed point problems with inexact function evaluations. *SIAM J. Scientific and Stat. Computing*, 12:725 – 742, 1991.
- [37] C. T. Kelley, E. W. Sachs, and B. Watson. A pointwise quasi-Newton method for unconstrained optimal control problems, II. *J. Optim. Theory Applic.*, 71, 1991.
- [38] F.-S. Kupfer and E. W. Sachs. A prospective look at SQP methods for semilinear parabolic control problems. In K.-H. Hoffmann and W. Krabs, editors, *Optimal Control of Partial Differential Equations, Irsee 1990*, volume 149 of *Lect. Notes in Control and Inform. Sciences*, pages 143–157. Springer, 1991.
- [39] C. T. Kelley and E. W. Sachs. Mesh independence of Newton-like methods for infinite dimensional problems. *J. of Integral Equations and Applic.*, 3:549–573, 1991.
- [40] M. Heinkenschloß, M. Laumen, and E. W. Sachs. Gauß-Newton methods with grid refinement. In W. Desch, F. Kappel, and K. Kunisch, editors, *Estimation and Control of Distributed Parameter Systems, Vorau 1990*, volume 100 of *Int. Series Num. Math.*, pages 161–174, Basel, Boston, Berlin, 1991. Birkhäuser.
- [41] C. T. Kelley and E. W. Sachs. Mesh independence of the gradient projection method for optimal control problems. *SIAM J. Control and Optimization*, 30:477–493, 1992.
- [42] E. W. Sachs. Topics in modern computational methods for optimal control problems. In W. Krabs and J. Zowe, editors, *Modern Methods of Optimization, Bayreuth, 1990*, volume 378 of *Lect. Notes in Econ. and Mathem. Systems*, pages 313–348. Springer, 1992.
- [43] P. Gritzmann, R. Hettich, R. Horst, and E. Sachs, editors. *Operations Research '91*. Physica-Verlag, 1992.
- [44] F.-S. Kupfer and E. W. Sachs. Numerical solution of a nonlinear parabolic control problem by a reduced SQP method. *Computational Optimization and Applications*, 1:113–135, 1992.
- [45] C. T. Kelley and E. W. Sachs. Multilevel algorithms for constrained optimal control problems. In *Proceedings of Copper Mountain Conference on Iterative Methods, Copper Mountain, 1992*, 1992.
- [46] K. Kunisch and E. W. Sachs. Reduced SQP methods for parameter identification problems. *SIAM J. Numer. Anal.*, 29:1793–1820, 1992.
- [47] C. T. Kelley and E. W. Sachs. Pointwise Broyden methods. *SIAM J. Optimization*, 3:423–441, 1993.
- [48] F.-S. Kupfer and E. W. Sachs. Reduced SQP methods for nonlinear heat conduction problems. In R. Bulirsch, A. Miele, J. Stoer, and K. H. Well, editors, *Optimal Control, Oberwolfach 1991*, volume 111 of *Int. Series Num. Math.*, pages 145–160. Birkhäuser, 1993.
- [49] C. T. Kelley and E. W. Sachs. Multilevel algorithms for constrained compact fixed point problems. *SIAM J. Scientific and Stat. Computing*, 15:645–667, 1994.
- [50] F. Leibfritz and E. W. Sachs. Numerical solution of parabolic state constrained control problems using SQP- and interior-point-methods. In W. W. Hager, D. W. Hearn, and P. M. Pardalos, editors, *Large Scale Optimization: State of the Art*, pages 251 – 264. Kluwer, 1994.
- [51] E. W. Sachs. Control applications of reduced SQP methods. In R. Bulirsch and D. Kraft, editors, *Computational Optimal Control*, volume 115 of *Int. Series Num. Math.*, pages 89–104. Birkhäuser, 1994.

- [52] M. Heinkenschloss and E. W. Sachs. Numerical solution of a constrained control problem for a phase field model. In W. Desch, F. Kappel, and K. Kunisch, editors, *Conference on Control and Estimation of Distributed Parameter Systems: Nonlinear Phenomena*, volume 118 of *Int. Series Num. Math.*, pages 171–187, Basel, Boston, Berlin, 1994. Birkhäuser.
- [53] C. T. Kelley and E. W. Sachs. Solution of optimal control problems by a pointwise projected Newton method. *SIAM J. Control and Optimization*, 33:1731 – 1757, 1995.
- [54] G. Gramlich, R. Hettich, and E. Sachs. SQP-methods for semi-infinite programming. *SIAM J. Optimization*, 5:641–658, 1995.
- [55] S. Ito, C. T. Kelley, and E. W. Sachs. Inexact primal-dual interior point iteration for linear programs in function spaces. *Computational Optimization and Applications*, 4:189–202, 1995.
- [56] H. Jäger, E. W. Sachs, H. Heidemüller, F. Maschler, H. Klammer, and G. Woelk. Optimization methods in the process control of industrial furnaces. In M. Gunzburger J. Borggaard, J. Burkardt and J. Peterson, editors, *Optimal Design and Control*, volume 19 of *Progress in Systems and Control Theory*, pages 215–228. Birkhäuser, 1995.
- [57] F. Leibfritz and E. Sachs. SQP interior point methods for parabolic control problems. In E. Casas, editor, *Control of Partial Differential Equations and Applications*, volume 174 of *Lect. Notes in Pure and Appl. Mathematics*, pages 181–192. Marcel Dekker, 1995.
- [58] M. Laumen and E. W. Sachs. Concepts of Newton and quasi-Newton methods for optimal shape design problems. *Control and Cybernetics*, 25:895 – 916, 1996.
- [59] D. Kleis and E. W. Sachs. Optimierung der industriellen Sterilisierung von Lebensmitteln mittels mathematischer Verfahren. Technical Report 344, KIN Mitteilungen, 1996.
- [60] T. Rautert and E. W. Sachs. Computational design of output feedback controllers. *SIAM J. Optimization*, 7:837–852, 1997.
- [61] H. Jäger and E. W. Sachs. Global convergence of inexact reduced SQP methods. *Optimization, Methods and Software*, 7:83–110, 1997.
- [62] D. Kleis and E. W. Sachs. Convergence rate of the augmented Lagrangian SQP method. *J. Optim. Theory Applic.*, 95:49–74, 1997.
- [63] E.W. Sachs, H. Jäger, H. Heidemüller, H. Klammer, F. Maschler, and G. Woelk. Prozeßoptimierung bei Industrieöfen. In T. Lohmann K.-H. Hoffmann, W. Jäger and Schunck, editors, *Mathematik — Schlüsseltechnologie für die Zukunft*, pages 501 – 511. Springer-Verlag, 1997.
- [64] P. Gritzmann, R. Horst, E. Sachs, and R. Tichatschke, editors. *Recent Advances in Optimization*, volume 452 of *Lect. Notes in Econ. Mathem. Systems*. Springer-Verlag, 1997.
- [65] D. Kleis and E. W. Sachs. A modification of SQP methods with slack variables. Technical report, Universität Trier, Germany, 1997.
- [66] M. Fahl and E. W. Sachs. Modern optimization methods for structural optimization under flutter constraints. In E. Cliff J. Borggaard, J. Burns and S. Schreck, editors, *Computational Methods for Optimal Design and Control*, volume 24 of *Progress in Systems and Control Theory*, pages 137–150. Birkhäuser, 1998.
- [67] B. B. King and E. W. Sachs. Optimization techniques for stable reduced order controllers for partial differential equations. In W.W. Hager and P.M Pardalos, editors, *Optimal Control: Theory, Algorithms, and Applications*, pages 278–297. Kluwer, 1998.

- [68] C. T. Kelley and E. W. Sachs. Local convergence of the symmetric rank-one iteration. *Computational Optimization and Applications*, 9:43–63, 1998.
- [69] E. W. Sachs. Semi-infinite programming in control. In J.-J. Rückmann and R. Reemtsen, editors, *Semi-Infinite Programming*, pages 389 – 411. Kluwer, 1998.
- [70] E. Arian, A. Battermann, and E. W. Sachs. Approximation of the Newton step by a defect correction process. Technical report, Universität Trier, Germany, 1998.
- [71] C. T. Kelley and E. W. Sachs. A trust region method for parabolic boundary control problems. *SIAM J. Optimization*, 9:1064–1081, 1999.
- [72] F. Leibfritz and E. W. Sachs. Inexact SQP interior point methods and large scale optimal control problems. *SIAM J. Control and Optimization*, 38:272–293, 2000.
- [73] B. B. King and E. W. Sachs. Semidefinite programming techniques for reduced order systems with guaranteed stability margins. *Computational Optimization and Applications*, 17:37–59, 2000.
- [74] D. Kleis and E. W. Sachs. Optimal control of the sterilization of prepackaged food. *SIAM J. Optimization*, 10:1180–1195, 2000.
- [75] M. Fahl, E. W. Sachs, and C. Schwarz. Modeling heat transfer for optimal control problems in food processing. In *Proceedings of the 2000 IEEE International Conference on Control Applications, Anchorage, Alaska*, pages 530–536, 2000.
- [76] A. Battermann and E. W. Sachs. An indefinite preconditioner for KKT systems arising in optimal control problems. Technical report, Universität Trier, 2000.
- [77] A. Battermann and E. W. Sachs. Block preconditioner for KKT systems in PDE-governed optimal control problems. In R. H. W. Hoppe, K.-H. Hoffmann, and V. Schulz, editors, *Workshop on Fast Solutions of Discretized Optimization Problems*, pages 1–18. Birkhäuser, 2001.
- [78] E. W. Sachs and S. Volkwein. Augmented Lagrange-SQP methods with Lipschitz-continuous Lagrange multiplier updates. *SIAM J. Numer. Anal.*, 40:233–253, 2002.
- [79] E. Arian, M. Fahl, and E. Sachs. Trust-region proper orthogonal decomposition models by optimization methods. In *Proceedings of the 41st IEEE Conference on Decision and Control, Las Vegas, Nevada*, pages 3300 – 3305, 2002.
- [80] E. W. Sachs and M. Schulze. Convergence rates of Gauss-Newton methods for underdetermined systems. Technical report, Universität Trier, Germany, 2002.
- [81] M. Fahl and E. W. Sachs. Reduced order modelling approaches to PDE-constrained optimization based on proper orthogonal decomposition. In L. T. Biegler, O. Ghattas, M. Heinkenschloss, and B. van Bloemen Waanders, editors, *Large-Scale PDE-Constrained Optimization*, Lecture Notes in Computational Science and Engineering, Vol. 30, pages 268 – 280, Heidelberg, 2003. Springer-Verlag.
- [82] C. T. Kelley and E. W. Sachs. Truncated Newton methods for optimization with inaccurate functions and gradients. *J. Optim. Theory Applic.*, 116:83 – 98, 2003.
- [83] E. W. Sachs and R. Tichatschke, editors. *System Modeling and Optimization XX*. Kluwer, Boston, Dordrecht, London, 2003.
- [84] E. W. Sachs and M. Schulze. Financial applications for large-scale neural networks. Technical report, Universität Trier, Germany, 2003.

- [85] E. W. Sachs. Preconditioning for CG methods in Hilbert space. Technical report, Universität Trier, Germany, 2004.
- [86] E. W. Sachs and A. Sartenaer. A class of augmented Lagrangian algorithms for infinite-dimensional optimization with equality constraints. Technical report, 2004. submitted.
- [87] E. W. Sachs and C. Sievers. Numerical optimization of an inventory control problem. Technical report, Universität Trier, Germany, 2004.
- [88] J. Maruhn and E. W. Sachs. Robust static super-replication of barrier options in the Black-Scholes model. In A. Kurdila, P. M. Pardalos, and M. Zabrankin, editors, *Robust Optimization: Directed Design*, pages 127 – 143, Heidelberg, 2006. Springer-Verlag.
- [89] A. M. Giese, C. Kaebe, J. H. Maruhn, and E. W. Sachs. Efficient calibration for problems in option pricing. *PAMM*, 7:1062601–602, 2007.
- [90] F. Feitzinger, T. Hylla, and E. W. Sachs. Versions of inexact Kleinman-Newton methods for Riccati equations. *PAMM*, 7:1060505 – 506, 2007.
- [91] E. W. Sachs and A. K. Strauss. Efficient solution of a partial integro-differential equation in finance. *Applied Numerical Mathematics*, 58:1687–1703, 2008.
- [92] J. A. Burns, E. W. Sachs, and L. Zietsman. Mesh independence of Kleinman-Newton iterations for Riccati equations in Hilbert space. *SIAM J. Control and Optimization*, 47:2663 – 2692, 2008.
- [93] E. W. Sachs and M. Schu. Reduced order models (POD) for calibration problems in finance. In K. Kunisch, G. Of, and O. Steinbach, editors, *Numerical Mathematics and Advanced Applications, ENUMATH 2007*, pages 735 – 742, Heidelberg, 2008. Springer-Verlag.
- [94] A. Loerx, J. Maruhn, and E. W. Sachs. The role of adjoints in the calibration of local volatility models. Technical report, 2008. submitted.
- [95] F. Feitzinger, T. Hylla, and E. W. Sachs. Inexact Kleinman-Newton method for Riccati equations. *SIAM Journal on Matrix Analysis and Applications*, 31:272 – 288, 2009.
- [96] C. Kaebe, J. H. Maruhn, and E. W. Sachs. Adjoint based Monte Carlo calibration of financial market models. *Journal of Finance and Stochastics*, 13:351 – 379, 2009.
- [97] J. H. Maruhn and E. W. Sachs. Robust static hedging of barrier options in stochastic volatility models. *Mathematical Methods of Operations Research*, 70:405 – 433, 2009.
- [98] C. Kaebe, J. H. Maruhn, and E. W. Sachs. Speeding up Monte Carlo calibrations of jump diffusion models with adjoint calculus. 2009. submitted.
- [99] E. W. Sachs and M. Schu. Reduced order models in PIDE constrained optimization. *Control and Cybernetics*, 39:661–675, 2010.
- [100] R. Herzog and E. W. Sachs. Preconditioned conjugate gradient method for optimal control problems with control and state constraints. *SIAM Journal on Matrix Analysis and Applications*, 31:2291 – 2317, 2010.
- [101] E. W. Sachs and S. Volkwein. POD-Galerkin approximations in PDE-constrained optimization. *GAMM Reports*, 33:194 – 208, 2010.
- [102] E. W. Sachs and S. M. Sachs. Nonmonotone line searches for optimization algorithms. *Control and Cybernetics*, 40:1059 – 1075, 2011.

- [103] R. Münnich, M. Wagner, and E. W. Sachs. Numerical solution of optimal allocation problems in stratified sampling under box constraints. *Advances in Statistical Analysis*, 96:435 – 450, 2012.
- [104] F. Gerlich, A. M. Giese, J. H. Maruhn, and E. W. Sachs. Parameter identification in stochastic volatility models with time-dependent model parameters. *Comp. Optimization and Appl.*, 51:1137 – 1161, 2012.
- [105] E. W. Sachs and M. Schu. Gradient computation for model calibration with pointwise observations. In K. Kunisch et al., editor, *Control and Optimization with PDE Constraints*, volume 164 of *International Series of Numerical Mathematics*, pages 117 – 136, Heidelberg, 2013. Birkhäuser.
- [106] R. T. Münnich, M. Wagner, and E. W. Sachs. Calibration of estimator-weights via semismooth Newton method. *Journal of Global Optimization*, 52:471 – 485, 2012.
- [107] A. Loerx and E. W. Sachs. Model calibration in option pricing. *SQU Journal for Science*, 17:84 – 102, 2012.
- [108] E. W. Sachs and M. Schu. A priori error estimates for reduced order models in finance. *Mathematical Modelling and Numerical Analysis*, 47:449 – 469, 2013.
- [109] A. Günnel, R. Herzog, and E. W. Sachs. A note on preconditioners and scalar products in Krylov subspace methods for self-adjoint problems in Hilbert space. *ETNA*, 41:13 – 20, 2014.
- [110] E. W. Sachs, M. Schneider, and M. Schu. Adaptive trust-region pod methods in pde-constrained optimization. In G. Leugering et al., editor, *Trends in PDE Constrained Optimization*, volume 165 of *International Series of Numerical Mathematics*, pages 327 – 342, Heidelberg, 2014. Birkhäuser.
- [111] E. W. Sachs and M. Schneider. Reduced order models for the implied variance under local volatility. *Intern. J. Theoret. and Applied Finance*, 17(1450053):23 pages, 2014.
- [112] P. Benner, E. W. Sachs, and S. Volkwein. Model order reduction for PDE constrained optimization. In G. Leugering et al., editor, *Trends in PDE Constrained Optimization*, volume 165 of *International Series of Numerical Mathematics*, pages 303 – 326, Heidelberg, 2014. Birkhäuser.
- [113] R. Herzog and E. W. Sachs. Superlinear convergence of Krylov subspace methods for self-adjoint problems in Hilbert space. 2014. submitted.
- [114] L. Frerick, G. Müller-Fürstenberger, E. W. Sachs, and L. Somorowsky. Multi-objective optimization in an application of the Ramsey model. Technical report, University of Trier, 2015.
- [115] L. Frerick, E. W. Sachs, and L. Zimmer. Necessary optimality conditions for the control of partial integro-differential equations. In Al-Baali M, L. Grandinetti, and A. Purnama, editors, *Recent Developments in Numerical Analysis and Optimization*, Advances in Intelligent and Soft Computing, 2015. to appear.