Curriculum Vitae Bruno Welfert

1 Academic training

1986-1990 Ph.D. in Mathematics
University of California, San Diego
A posteriori error estimates and adaptive solution of fluid flow problems
Thesis Advisor: Randolph E. Bank

1984-1985 M.S. in Numerical Analysis, summa cum laude
Universite Pierre et Marie Curie (Paris VI), France

1982-1985 Engineering degree, summa cum laude
Ecole Centrale des Arts et Manufactures, Paris, France

1979 Baccalaureate, magna cum laude
Lycee de Toul, France

2 Employment

06/2004 Visiting Associate Professor
Department of Mathematics, University of Trieste, Italy

09/1996-07/1997 Visiting Associate Professor
Department of Mathematics and Computer Science, Leiden University,
Leiden, The Netherlands

08/1996– Associate Professor
Department of Mathematics, Arizona State University, Tempe, AZ

08/1990-07/1996 Assistant Professor
Department of Mathematics, Arizona State University, Tempe, AZ

07/1990 Research Engineer
Dassault Aviation, Paris, France

08/1986-06/1990 Teaching/Research Assistant
Department of Mathematics, University of California, San Diego, CA
supported by Dassault Aviation, France

08/1985-08/1986 Research Engineer
Nuclear Energy Commission, Vaujours, France

04/1984–06/1985 Internship
Solution of transonic flow equations with and without entropy correction via domain decomposition and finite element techniques
Avions Marcel Dassault, Breguet Aviation
Saint–Cloud, France

07/1984–08/1984 Internship (Fliessbandarbeiter)
Deutsche Bundesbahn, Diesellkomotiv Ausbesserungswerk
Bremen, Germany

3 Publications

Refereed

1. R. E. Bank and B. Welfert, *A Class of Iterative Methods for Solving Saddle Point Problems*, Numerische Mathematik 56 (1990) 645–666.

2. R. E. Bank and B. Welfert, *A Posteriori Error Estimates for the Stokes Problem: a Comparison*, Computer Methods in Applied Mechanics and Engineering 82:1-3 (1990) 323–340.

3. R. E. Bank and B. Welfert, *A Comparison between the Mini-Element and the Petrov-Galerkin Formulations for the Generalized Stokes Problem*, Computer Methods in Applied Mechanics and Engineering 83:1 (1990) 61–68.

4. R. E. Bank and B. Welfert, *A Posteriori Error Estimates for the Stokes Problem*, SIAM Journal on Numerical Analysis 28:3 (1991) 591–623.

5. B. Welfert, *On the Eigenvalues of Second-Order Pseudospectral Differentiation Operators*, Computer Methods in Applied Mechanics and Engineering 116 (1994) 281–292.

6. J. Victory, I. Miller, J. Sanchez, T. DeMassa, B. Welfert, *A New Physical Power MOSFET Model for Improved Simulation in power electronic design*, Power Electronics in Transportation, Proceedings (1994) 83–90.

7. J. Jones and B. Welfert, *Zero-free Regions for a Rational Function with Applications*, Advances in Computational Mathematics 3 (1995) 265–289

8. T. DeMassa, J. Sanchez and J. Victory and B. Welfert, *Applications of the MOS Charge-Sheet Model to Non-Uniform Doping Along the Channel*, Solid State Electronics 38:8 (1995) 1497–1503

9. K. Kitsios, A. Spanias and B. Welfert, *Optimum Block Modified Covariance Algorithm for Spectral Analysis*, 3rd Mediterranean Symposium on New Directions in Control and Automation, Limassol (1995) 398–405

10. R. Aguilar and B. Welfert, *Applied Numerical Methods and Graphical Visualization*, Computer Applications in Engineering Education 4:2 (1996) 127–143

11. J. J. Victory, J. J. Sanchez, T. A. DeMassa, B. D. Welfert, *A Static Physical VDMOS model based on the Charge-Sheet Model*, IEEE Transactions on Electron Devices, 43:1 (1996) 157–164.

12. K. Kitsios, A. Spanias and B. Welfert, *Adaptive modified covariance algorithms for spectral analysis*, Signal Processing 82 (2002) 715–720 (submitted in 1996).

13. B. Welfert, *Generation of Pseudospectral Differentiation Matrices, I.*, SIAM Journal on Numerical Analysis 34 (1997) 1640-1657.

14. K. Burrage, Z. Jackiewicz and B. Welfert, *Block Toeplitz Preconditioning for Static and Dynamic Linear Systems*, Linear Algebra and its Applications 279 (1998) 51-74.

15. Z. Jackiewicz, B. Owren and B. Welfert, *Pseudospectra of waveform relaxation operators*, Comput. Math. Appl. 36:8 (1998) 67–85.

16. B. Owren and B. Welfert, *The Newton Iteration on Lie Groups*, BIT 40:1 (2000) 121–145.

17. S. Tracogna and B. Welfert, *Two-Step Runge-Kutta Methods: Theory and Practice*, BIT 40:4 (2000) 775–799.

18. H. Kojouharov and B. Welfert, *A new numerical approach for the solution of advection-reaction equations*, Proceedings International Conf. on Scientific Computing and Mathematical Modeling, pp. 124–127 (D. Shultz, B. Wade, J. Vigo-Aguiar, and S.K. Dey, Eds.), Institute of Applied Science and Computations, Milwaukee, Wisconsin (2000)

19. J.L. Mead, R.A. Renaut, B.D. Welfert, *Stability of a Pivoting Strategy for Gaussian Elimination in Parallel*, BIT 41:3 (2001) 633–639.

20. K. Burrage, G. Hertono, Z. Jackiewicz, B. D. Welfert, *Acceleration of convergence of static and dynamic iterations*, BIT 41:4 (2001) 645–655.

21. H. V. Kojouharov and B.D. Welfert, *A New Numerical Approach for the Solution of Scalar Nonlinear Advection-Reaction Equations*, Int. Journal of Applied Science & Computations, 8:2 (2001) 119-126.

22. A. Gelb, J. Jackiewicz and B. Welfert, *Absorbing boundary conditions of the second order for the pseudospectral Chebyshev methods for wave propagation*, J. Sci. Comp., 17:1-4 (2002) 501–512.

23. Z. Jackiewicz and B. Welfert, *Stability of Gauss-Radau pseudospectral approximations of the one-dimensional wave equation*, J. Sci. Comp., 18:2 (2002) 287–313.

24. H. Kojouharov and B. Welfert, *A nonstandard Euler scheme for y"+g(y)y'+f(y)y = 0*, Journal of Comp. Appl. Math., 151:2 (2003) 335–353.

25. M. N. Spijker, S. Tracogna and B. Welfert, *About the Sharpness of the Stability Estimates in the Kreiss Matrix Theorem*, Mathematics of Computation, 72 (2003) 697–713.

26. B. Welfert, *Matlab Manual*, to accompany *Fundamentals of Differential Equations*, 6th ed. by R. Nagle, E. Saff & A. Snider, Addison-Wesley, 2003.

27. H.V. Kojouharov and B.D. Welfert, *Generalized Nonstandard Numerical Methods for Nonlinear Advection-Diffusion-Reaction Equations*, Lecture Notes in Computer Science 2907, Large-Scale Scientific Computing, pp. 465 - 472 (Lirkov et al., Eds.), Springer-Verlag Berlin Heidelberg, 2004

28. Z. Jackiewicz, B. Welfert and B. Zubik-Kowal, *Spectral vs. pseudospectral solutions of the wave equation by relaxation methods*, J. Scientific computing, 20:1 (2004) 1–28.

29. A. A. Rodriguez, R. P. Metzger, O. Cifaloz, T. Dhirasakdanon and B. Welfert, *Modelling, simulation, animation, and real-time control (MoSART) for a class of electromechanical systems: a system-theoretic approach*, Int. J. Math. Education in Science and Technology 35 (2004) 877–896.

30. Z. Jackiewicz, M. Rahman and B.D. Welfert, *Numerical solution of a Fredholm integro-differential equation modeling neural networks*, Applied Numerical Mathematics 56 (2006) 423–432.

31. K.J. in 't Hout and B.D. Welfert, *Stability of ADI schemes applied to convection–diffusion equations with mixed derivative terms*, Applied Numerical Mathematics (2006) in press.

Submitted

32. F. Hoppensteadt, M. Rahman and B. Welfert, *Central Limit Theorems for Markov Processes with applications to circular processes*, Advances in Applied Probability, 2005.

33. B. Welfert, *Analysis of Iterated ADI-FDTD Schemes for Maxwell Curl Equations*, Journal of Computational Physics, 2005.

34. B. Welfert, *Structure of ADI spectra*, Journal of Computational Physics, 2006.

Technical reports

35. B. Welfert, *A Remark on Pseudospectral Differentiation Operators*, 1994, Department of Mathematics, Arizona State University, Tempe, Arizona (originally submitted to SIAM J. Numer. Anal.)

36. B. Welfert, *Convergence of Inexact Uzawa Algorithms for Saddle Point Problems*, 1994, Department of Mathematics, Arizona State University, Tempe, Arizona.

37. S. Tracogna and B. Welfert, *Numerical differentiation and Peano kernel functions*, Rept TW-97-01, January 1997, Leiden University, Department of Mathematics and Computer Science, Leiden University, The Netherlands.

38. S. Tracogna and B. Welfert, *Spectral Analysis of Generalized Top to Random Shuffles*, Rept TW-97-04, June 1997, Leiden University, Department of Mathematics and Computer Science, Leiden University, The Netherlands.

39. B. Welfert and J. T. Aberle, *Computation of Higher–Order Tangential Vector Finite Element Matrices*, 1996, Department of Mathematics & Electrical Engineering, Arizona State University (originally submitted to Electromagnetics, rejected)

40. B. Welfert, *Notes on Riffle Shuffle*, 1997, Department of Mathematics, Arizona State University, Tempe, Arizona.

41. B. Welfert and J. T. Aberle, *On the role of gradient fields in vector FE solutions of Maxwell's equations: higher order elements vs. penalty method*, Oct. 1997, Department of Mathematics & Electrical Engineering, Arizona State University (originally submitted to J. Computational Physics, rejected)

42. K. Burrage, Z. Jackiewicz, B. D. Welfert, *Spectral Approximation of time windows in the solution of dissipative linear differential equations*, 2000, Department of Mathematics, Arizona State University, Tempe, Arizona (originally submitted to J. Comp. Applied Math., rejected)

43. R. Heap, S. Shephard, J. Sherwood and B. Welfert, *On the derivation and simulation of a model of double suspension roof*, 2003, Department of Mathematics, Arizona State University, Tempe, Arizona (originally submitted to Engineering Structures)

44. A. Al-Rabtah and B. Welfert, *Algebraic interpretation and stability of one-dimensional enslaved finite difference schemes*, Dec. 2002, Department of Mathematics, Arizona State University, Tempe, Arizona.

45. Z. Jackiewicz, S. Maset, B. Welfert and M. Zennaro, *Exponential Runge-Kutta methods for ordinary differential equations*, 2006, Department of Mathematics, University of Trieste, Italy.

4 Funding

External

1. *Development of an Interactive Systems and Controls E-Book* (10% co-PI), National Science Foundation DUE 0231440, Arizona State University, 2003-2006, $307,910.00.

2. *High Order Reconstruction Using Spectral Methods* (25% co-PI), National Science Foundation DMS 0510813, Arizona State University, 2005-2008, $226,547.00.

3. *Stochastic Parametric Forcing in Hydrodynamics* (50% co-PI), National Science Foundation DMS 0505489, Arizona State University, 2005-2008, $294,390.00.

University

1. *Educational Tools for Numerical Methods* (100% PI), Arizona State University, CLAS grant to improve undergraduate education, Arizona State University, 1995, $4,500.

2. *Nonlinear Analysis of Failure Modes in MEMS Devices* (33% co-PI), Arizona State University, CLAS multidisciplinary grant, 2003, $20,000.

3. *Preparing Life Science Students in Scientific Research* (33% co-PI), Arizona State University, CLAS grant to improve undergraduate education, 2003, $14,815.

4. *Preparing Students in Scientific Research* (25% co-PI), Arizona State University, CLAS grant to improve undergraduate education, 2004, $14,923.

5 Invited talks & posters

Conferences and symposia

1. *Iterative Method for Saddle Point Problems*, International Conference on Finite Element Methods in Engineering, Hunstville, Alabama, April 1989.

2. *A Posteriori Error Estimates for the Stokes Problem*, SIAM Annual meeting, San Diego, California, June 1990.

3. *Error Estimates and Adaptive Solution of Physical Problems*, Forum USA 92, Los Angeles, April 1992.

4. *On the Eigenvalues of Second-Order Pseudospectral Differentiation Operators*, 2nd International Conference on Spectral and High Order Methods, Montpellier, France, June 1992.
5. *Towards Adaptive Spectral Methods*, Adaptive Methods in Partial Differential Equations, Oberwolfach, Germany, Oct. 10–16, 1993.
6. *On the Convergence of Inexact Uzawa Algorithms*, Colorado Conference on Iterative Methods, Breckenridge, Colorado, April 5–9, 1994.
7. *Block Toeplitz preconditioning for static and dynamic linear systems*, Volterra Centennial, Arizona Ste University, Tempe, Arizona, May 30, 1996.
8. *Hierarchical vector finite elements and a posteriori error estimation for Maxwell's equations*, Progress in Electromagnetics Research Symposium, Innsbruck, Austria, July 1996.
9. *On some combinatorial aspects of riffle shuffles with an application to the reduction of order conditions in the analysis of Runge-Kutta methods of the Crouch-Grossmann type*, Workshop on the Numerical Solution of Ordinary Differential Equations on Manifolds, Arizona State University, Tempe, Arizona, April 2-3, 1998.
10. *Trails & tribulations in establishing a new BS degree in Computational Mathematical Sciences at ASU*, Excellence in Undergraduate Mathematics: Mathematics for the Non- traditional Major, American Mathematical Society-Mathematical Education Reform Workshop, Washington University, St. Louis, MO, May 2-5, 2002.
11. *Stability of pseudospectral approximations of the one-dimensional wave equation*, Conference on Scientific Computation, Geneva, Switzerland, June 26–29, 2002.
12. *A Navier-Stokes system with stochastic parametric forcing*, NA day on Numerical Analysis and Geometric Integration, Ljubljana, Slovenia, June 10, 2004.
13. *Numerical solution of a Fredholm integro-differential equation modeling neural networks*, 3rd International Conference on the Numerical Solution of Volterra and Delay Equations, Tempe, Arizona, May 18–24, 2004.
14. *Stochastic Parametric Forcing in Hydrodynamics*, NISS/SAMSI Workshop on Collaborations in the Mathematical Geosciences, Poster, Raleygh, Oct. 2005.
15. *Impact of noise on the onset of vortex breakdown*, 58th Annual Meeting of the Division of Fluid Dynamics, American Physical Society, Chicago, Nov. 2005.
16. *Stochastic Parametric Forcing in Hydrodynamics*, Los Alamos Arizona Days 2006 – Emerging Paradigms in Nonlinear Science Workshop, January 25–28, 2006, Los Alamos, New Mexico.

Colloquia and seminars at other universities

1. *Sur la determination des matrices de derivation dans les methodes pseudospectrales*, University of Fribourg, Switzerland, June 16, 1992.
2. *Zero-free Regions of* $\phi_n(z) = \sum_{i=1}^{n}(z-p_i)^{-1} - \sum_{i-1}^{n-1}(z-q_i)^{-1}$ *with applications*, Stanford University, California, Jan. 1993.
3. *On the Determination of Higher-Order Pseudospectral Matrices*, University of California, San Diego, California, March 1993.
4. *Preconditioning of waveform relaxation*, Institutt for Informatikk, University of Bergen, Norway, Sept. 19, 1996.
5. *A nonstandard Euler scheme for* $y'' + g(y)y' + f(y)y = 0$, Department of Mathematics, University of Texas at Arlington, Texas, Nov. 28, 2000.
6. *Spectral methods for the wave equation*, University of Fribourg, Switzerland, June 2002.
7. *What is stiff order?*, Department of Mathematics, University of Udine, Italy, May 2004.

Presentations at ASU

1. *On the determination of pseudospectral differentiation matrices*, Department of Mathematics, Sept. 10, 1992.
2. *Adaptive finite element solution of PDEs in a nutshell*, Department of Mathematics, Mar. 22, 1995.
3. *A priori and a posteriori error estimates in finite element methods*, Telecommunication Research Center, Arizona State University, April 12, 1995.
4. *Effects of overlap in the convergence of iterative processes*, Department of Mathematics, 1996.
5. *Numerical differentiation and Peano kernel functions*, Department of Mathematics, Sep. 4, 1997.
6. *Spectral Analysis of Generalized Top to Random Shuffles*, Department of Mathematics, Sep. 23, 1997.
7. *Notes on Riffle Shuffles*, Department of Mathematics, Sep. 30, 1997.
8. *The Newton Iteration on Lie Groups*, Department of Mathematics, Oct. 14, 1997.
9. *On the finite element solution of Maxwell's equations*, Telecommunication Research Center, Arizona State University, Nov. 1997.
10. *A Time-Splitting Method for Nonlinear Advection-Diffusion-Reaction Equations*, Computational Math Proseminar, Nov. 4, 1999.
11. *Stability of Pseudospectral Approximations of 1d Hyperbolic Problems*, Computational Math Proseminar, Sept 20, 2001.
12. *On the derivation and simulation of a model of double suspension roof*, Computational Math Proseminar, Department of Mathematics, Mar. 21, 2002.
13. *Alternating Direction Implicit FDTD Methods for solving Maxwell's Curl Equations*, Dept. Math. & Stats, Nov. 10, 2005.

Teaching

Courses taught

1. Calculus II (sophomore undergraduate)
   Developed Maple tools
2. Calculus III (sophomore undergraduate)
   Developed Maple tools
3. Elementary Differential Equations (sophomore undergraduate)
4. Modern Differential Equations (with Matlab, sophomore undergraduate)
   Developed course, supported by College grant, wrote MATLAB & SIMULINK–based projects
5. Linear Algebra (junior undergraduate)
6. Modern Linear Algebra (with MATLAB) (junior undergraduate)
7. Advanced Mathematics for Engineers and Scientists (junior undergraduate)
8. Applied Computational Methods (senior undergraduate)
   Developed course, 300+page lecture notes
9. Numerical Analysis I (senior undergraduate)
10. Numerical Analysis II (senior undergraduate)
11. Numerical Linear Algebra (graduate)

12. Iterative Methods (graduate)
13. Numerical Partial Differential Equations (graduate)
14. Numerical Solution of Ordinary Differential Equations (graduate)
15. Numerical Solution of Stiff Differential Systems (graduate)
16. Spectral Methods for Partial Differential Equations (graduate)

Student supervision

Ph.D. graduates

1. Dr. Leigh Little, Assistant Professor, Department of Computational Science, State University of New York ("A finite element solver for the Navier–Stokes equations using a preconditioned adaptive BICGSTAB(L)", 1998, co-chair with Prof. H. Mittelmann, ASU)
2. Dr. Adel Helal Al–Rabtah, Assistant Professor, Department of Mathematics & Statistics, Mu'tah University, Jordan ("Algebraic Interpretation and Stability of Enslaved Finite Difference Schemes", 2002)
3. Dr. M. Mahbubur Rahman, Assistant Professor, Department of Mathematics & Statistics, University of North Florida ("Numerical Approximations of Stochastic Differential Equations with Applications to Mathematical Neurosciences", 2004, co–chair with Prof. Z. Jackiewicz, ASU)

M.A & M.S. graduates

1. Hattan Tawfig, 1994
2. Derar Serhan, 1994
3. Alaric Fox, 1995

Undergraduate

1. Ricardo Aguilar, June–July 1995 (college sponsored).
2. Shane Silkey, Sept–Dec 2005 (Research Experience for Undergraduate).

Service

Arizona State University

- Department of Mathematics & Statistics
  - Undergraduate Advisory Committee (1992–1995, 2000–2001)
  - Graduate Advisory Committee (1998–1999)
  - Undergraduate advisor (1999–2002, 2005–current)
  - Computing Committee (1993–1995)
  - Engineering Liaison committee
  - Lecturer evaluation committee (2001)
  - Ph.D. examination committees
  - Oversight Calculus committee (chair, 2004–current)
  - Course coordinator (Calculus II, Elementary Differential Equations)
- College of Liberal Arts & Sciences

  - committee on Quality of Instruction (1999–2002)
  - Curriculum committee (1999–2003)

- University
  - Graduate College Representative at Ph.D defenses (1993–1995)
  - Faculty Ambassador (1994–1995)

Community

- Refereeing
  - Articles
    Advances in Computational Mathematics, American Mathematical Monthly, Applied Numerical Mathematics, Impact of Computing in Science and Engineering, Journal of Computational and Applied Mathematics, Journal of Computational Physics, SIAM Frontiers in Applied Mathematics, SIAM Journal on Matrix Analysis and Applications, SIAM Journal on Numerical Analysis, SIAM Journal on Scientific Computing.
  - Books
    Addison–Wesley–Longman, Brooks–Cole, Harper–Collins, Pearson/Prentice–Hall, SIAM, Wadsworth, WH Freeman.
  - Proposals
    National Science Foundation

- Consulting
  - Valley Tool Room, Inc., April 1993.
    Modified Sine-Curve Motion of a Cam.
  - Skill Technologies Inc., Scottsdale, Arizona, Jan. 2000.
    Development and implementation of a strategy for moving map of 3D space from electromagnetic readings.
  - Flow Technology, Phoenix, Arizona, Sep–Nov 2001.
    Interpolation of 3D scattered data from flow measurements with multiquadrics.

- Judging
  1. Intel International Science and Engineering Fair, Grand Award Judge, Phoenix, May 2005.
  2. More Graduate Education at Mountain States Alliance and Western Alliance to Expand Student Opportunities, ASU Tempe, April 2006.

- Organizing conference
  1. NODEM98, Arizona State University, April 2–3, 1998 (with Prof. Z. Jackiewicz; about 60 participants).

- Focus groups
  1. Addison-Wesley focus group, AMS annual meeting, Phoenix, AZ, Jan. 9, 2004
  2. W. H. Freeman calculus focus group, San Francisco, February 23–24, 2006.
  3. Mathematics Articulation Task Force, Arizona (1998–1999)