

CURRICULUM VITAE

BAO, WEIZHU Assistant Professor
Department of Computational Science
National University of Singapore

PERSONAL DATA:

Born: 27 September 1969, Shaanxi Province, P. R. China; Singapore PR holder

EDUCATIONAL BACKGROUND:

Ph.D. & M.S., Computational Mathematics, June 1995, Tsinghua University
B.S., Applied Mathematics, February 1992, Tsinghua University

EMPLOYMENT HISTORY:

a). Regular Positions

Assistant Professor, Department of Computational Science, National University of Singapore, Singapore, January 2001 –

Van Vleck Visiting Assistant Professor, Department of Mathematics, University of Wisconsin-Madison, USA, August 2000 – December 2000

Visiting Assistant Professor, School of Mathematics, Georgia Institute of Technology, USA, September 1998 – July 2000

Associate Professor, Department of Applied Mathematics, Tsinghua University, China, June 1998 – August 1998

EPSRC Postdoc Research Associate, Department of Mathematics, Imperial College, UK, January 1996 – March 1997

Lecturer, Department of Applied Mathematics, Tsinghua University, China, August 1995 – December 1995 & April 1997 – May 1998

Teaching Assistant, Department of Applied Mathematics, Tsinghua University, China, February 1992 – June 1995

b). Visiting Positions (> One month)

Visiting Scientist, Ewin Schrödinger Institute, Vienna, Austria, May 2001 – June 2001.

CURRENT FIELDS OF INTEREST:

Bose-Einstein condensation
Computational fluid dynamics
Hyperbolic conservation laws
Finite element Method for some nonlinear problems
Numerical methods for problems with multiscale phenomena
Numerical methods for partial differential equations in unbounded domains
Numerical Analysis and Scientific Computing, Applied Mathematics in general

TEACHING EXPERIENCE

National University of Singapore:

Term 1	2003/2004	CZ5103 Modeling and Simulation	15 students
		CZ2288 UROPS Project	2 students
Term 2	2002/2003	CZ4105 Numerical Methods for PDEs	15 students
		CZ2288 UROPS Project	1 student
Term 1	2002/2003	CZ5274 Computational Fluid Dynamics	14 students
Term 2	2001/2002	CZ3105 Numerical Methods II	67 students
		SFM Projects (3 projects)	7+7+7 students
		USCZ3602 (ISM module)	1 student
		NUS Science Mentorship Program	2 students
Term 1	2001/2002	CZ3206 Symbolic Computing	53 students
		SFM Projects (3 projects)	5+5+6 students
Term 2	2000/2001	CZ2103 Numerical Methods II	98 students
		SFM Projects (3 projects)	5+5+6 students

University of Wisconsin-Madison:

Fall	2000	Math 320 Linear Algebra & DEs (2 classes)	30+30 students
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Georgia Institute of Technology:

Spring	2000	Math 2401 Calculus III	70 students
Fall	1999	Math 1501 Calculus I	80 students
Winter	1999	Math 2508 Calculus V (2 classes)	39+37 students
Fall	1998	Math 2508 Calculus V	39 students

Tsinghua University:

Spring	1998	Numerical solutions for PDEs	12 students
Fall	1997	Data Structure	38 students
		Numerical Analysis	120 students

Summer	1997	Mathematics Modeling	8 students
Fall	1995	Finite Element Methods and Theory	20 students
		Mathematical Analysis	50 students
Summer	1995	Mathematics Modeling	8 students

REFEREED PUBLICATIONS:

a). Already published:

1. Numerical study of time-splitting spectral discretization of nonlinear Schrödinger equations in the semi-classical regimes (with S. Jin and P.A. Markowich), *SIAM J. Sci. Comput.*, Vol. **25**, No. 1, pp. 27 - 64, 2003.
2. An explicit unconditionally stable numerical method for solving damped nonlinear Schrodinger equations with a focusing nonlinearity, (with D. Jaksch), *SIAM J. Numer. Anal.*, Vol. **41**, No. 4, pp. 1406 - 1426, 2003.
3. Numerical methods for the generalized Zakharov system (with F. Sun and G.W. Wei), *J. Comput. Phys.*, Vol. **190**, No. 1, pp. 201 - 228, 2003.
4. Numerical solution of the Gross-Pitaevskii equation for Bose-Einstein condensation (with D. Jaksch and P.A. Markowich), *J. Comput. Phys.*, Vol. **187**, No. 1, pp. 318 - 342, 2003.
5. Ground state solution of Bose-Einstein condensation by directly minimizing the energy functional (with W. Tang), *J. Comput. Phys.*, Vol. **187**, No. 1, pp. 230 - 254, 2003.
6. Error bounds for the finite element approximation of the exterior Stokes equations in two dimensions, *IMA J. Numer. Anal.*, Vol. **23**, No. 1, pp. 125-148, 2003.
7. Error bounds for the finite element approximation of an incompressible material in an unbounded domain (with H. Han), *Numer. Math.*, Vol. **93**, No. 3, pp. 415-444, 2003.
8. An economical finite element approximation of a generalized Newtonian flow, *Comput. Methods Appl. Mech. Engrg.*, Vol. **191**, No. 33, pp. 3637-3648, 2002.
9. The random projection method for stiff multi-species detonation capturing (with S. Jin), *J. Comput. Phys.*, Vol. **178**, No. 1, pp. 37-57, 2002.
10. On time-splitting spectral approximation for the Schrödinger equation in the semiclassical regime (with S. Jin and P.A. Markowich), *J. Comput. Phys.*, Vol. **175**, pp. 487-524, 2002.
11. The random projection method for stiff detonation waves (with S. Jin), *SIAM J. Sci. Comput.*, Vol. **23**, No. 3, pp. 1000-1026, 2001.

12. Error estimates for the finite element approximation of linear elastic equations in an unbounded domain (with H. Han), *Math. Comp.*, Vol. **70**, pp. 1437-1459, 2001.
13. On inf-sup conditions of mixed finite element formulations for acoustic fluids (with X. Wang and K.J. Bathe), *Math. Models Methods Appl. Sci.*, Vol. **11**, No. 5, pp. 883-901, 2001
14. Numerical simulations of fracture problems by coupling the FEM and the direct method of lines (with H. Han and Z. Huang), *Comput. Methods Appl. Mech. Engrg.*, Vol. **190**, pp. 4831-4846, 2001.
15. Weakly compressible high-order I-stable central difference schemes for incompressible viscous flows (with S. Jin), *Comput. Methods Appl. Mech. Engrg.*, Vol. **190**, pp. 5009-5026, 2001.
16. The random projection method for hyperbolic conservation laws with stiff reaction terms (with S. Jin), *J. Comput. Phys.*, Vol. **163**, pp. 216-248, 2000.
17. Artificial boundary conditions for incompressible Navier-Stokes equations: A well-posed result, *Comput. Methods Appl. Mech. Engrg.*, Vol. **188**, pp. 595-611, 2000.
18. The artificial boundary conditions for computing the flow around a submerged body (with. Wen X.), *Comput. Methods Appl. Mech. Engrg.*, Vol. **188**, pp. 473-482, 2000.
19. High-order local artificial boundary conditions for problems in unbounded domains (with H. Han), *Comput. Methods Appl. Mech. Engrg.*, Vol. **188**, pp. 455-471, 2000.
20. Error estimates for the finite element approximation of problems in unbounded domains (with H. Han), *SIAM J. Numer. Anal.*, Vol. **37**, No. 4, pp. 1101-1119, 2000.
21. The discrete artificial boundary condition on a polygonal artificial boundary for the exterior problem of Poisson equation by using the direct method of lines (with H. Han), *Comput. Methods Appl. Mech. Engrg.*, Vol. **179**, pp. 345-360, 1999.
22. The direct method of lines for the problem of infinite elastic foundation (with H. Han), *Comput. Methods Appl. Mech. Engrg.*, Vol. **175**, pp. 157-173, 1999.
23. A priori and posteriori error bounds for nonconforming linear finite element approximation of a non-Newtonian flow (with J. W. Barrett), *M²AN Math. Model. Numer. Anal.*, Vol. **32**, pp. 843-858, 1998.
24. The artificial boundary conditions for incompressible materials on an unbounded domain (with H. Han), *Numer. Math.*, Vol. **77**, pp. 347-363, 1997.

25. Numerical simulation for the problem of infinite elastic foundation (with H. Han and T. Wang), *Comput. Methods Appl. Mech. Engrg.*, Vol. **147**, pp. 369-385, 1997.
26. Artificial boundary conditions for two-dimensional incompressible viscous flows around an obstacle, *Comput. Methods Appl. Mech. Engrg.*, Vol. **147**, pp. 263-273, 1997.
27. Nonlocal artificial boundary conditions for the incompressible viscous flow in a channel using spectral techniques (with H. Han), *J. Comput. Phys.*, Vol. **126**, pp. 52-63, 1996.
28. An artificial boundary condition for the incompressible viscous flows using the method of lines (with H. Han), *Int. J. Numer. Methods Fluids*, Vol. **22**, pp. 483-493, 1996.
29. An artificial boundary condition for the incompressible viscous flows in a no-slip channel (with H. Han), *J. Comput. Math.*, Vol. **13**, pp. 51-65, 1995.
30. A discrete artificial boundary condition for steady incompressible viscous flows in a no-slip channel using a fast iterative method (with H. Han and J. Lu), *J. Comput. Phys.*, Vol. **114**, pp. 201-208, 1994.

Accepted:

1. Ground states and dynamics of multi-component Bose-Einstein condensates, *SIAM Multiscale Modeling and Simulation*, to appear.
2. Computing the ground state solution of Bose-Einstein condensates by a normalized gradient flow (with Q. Du), *SIAM J. Sci. Comput.*,
3. Three Dimensional Simulation of Jet Formation in Collapsing Condensates (with D. Jaksch and P.A. Markowich), *J. Phys. B: At. Mol. Opt. Phys.*, to appear.

Submitted:

1. Numerical methods for nonlinear Schroedinger equation under nonzero far-field conditions, preprint.

COLLOQUIA AND SEMINARS:

- Department of Mathematics, University of Maryland, USA, December 2003.
- Institute of Computational Mathematics & Scientific/Engineering Computing, Beijing, December 2002.
- Beijing Institute of Applied Physics and Computational Mathematics, Dec. 2002.
- Department of Mathematical Science, Tsinghua University, December 2002.

- Dept. of Math., Hong Kong University of Science and Technology, Sept 2002.
- Wolfgang Pauli Institute, Vienna, Austria, July 2002.
- Dept. of Applied Math., National Sun Yat-sen University, Taiwan, June 2002.
- Department of Mathematics, National Cheng Kung University, Taiwan, June 2002.
- Department of Mathematics, National Chung Cheng University, Taiwan, June 2002.
- Department of Mathematics, National Taiwan University, June 2002.
- Department of Mathematics, National University of Singapore, March 2002.
- Institute of Mathematics, Chinese Academy of Science, December 2001.
- Beijing Institute of Applied Physics and Computational Mathematics, Dec. 2001.
- Department of Scientific and Engineering Computing, Peking University, Dec. 2001.
- Department of Mathematical Science, Tsinghua University, December 2001.
- Tamesek laboratory, National University of Singapore, November 2001
- Department of Computational Science, National University of Singapore, July 2000
- Department of Mathematics, Emory University, February 2000
- School of Mathematics, Georgia Institute of Technology, December 1998
- Department of Applied Mathematics, Tsinghua University, March 1998
- Department of Mathematics, Peking University, September 1997
- Department of Applied mathematics, Tsinghua University, April 1997
- Department of Applied Mathematics, Tsinghua University, April 1995

MEETINGS AND SYMPOSIA:

a). Invited

- Invited Minisymposium on “Discrete Singular Convolution for Solving PDEs”, ICIAM 2003: The 5th International Congress on Industrial and Applied Mathematics, Sydney, Australia July 7-11, 2003.
- Invited Minisymposium on “The Nonlinear Schroedinger Equations: Analysis, Numerics and Applications”, ICIAM 2003: The 5th International Congress on Industrial and Applied Mathematics, Sydney, Australia July 7-11, 2003.

- Invited Minisymposium on “Numerical solutions of partial differential equations”, ICM2002-Beijing Satellite Conference on Scientific Computing, Xi’an Jiaotong University, Xi’an, China, Aug. 15–18, 2002.
- Invited Minisymposium on “Modeling and Numerical Issues in Multi-scale Problems”, SIAM 50th Anniversary and 2002 Annual Meeting, July 8-12, 2002, Philadelphia, USA.
- Workshop on Multiscale Analysis and Computation, Center for Theoretical Studies (CTS), National Tsinghua University, Taiwan, June 24-28, 2002.
- Workshop on “Semiclassical limits: WKB methods vs Wigner transform methods”, Vienna, Austria, November 22 - 27, 2001.
- 2nd NUS-IHPC Workshop on Computational Methods in Science and Engineering, National University of Singapore, 25 September 2001.
- Invited Minisymposium on “Instability Analysis of Fluid-Solid Systems”, First M.I.T. Conference on Computational Fluid and Solid Mechanics, Massachusetts Institute of Technology, USA, June 12-15, 2001.
- Invited Minisymposium on “The Direct Method of Lines in DDM and related topics”, 12th International Conference on Domain Decomposition Methods, Chiba University, Chiba, Japan, October 25-29, 1999.
- Workshop on Scientific Computing 99, Baptist University, Hong Kong, June 27-30, 1999
- Invited Minisymposium on “Numerical Methods on Multiscale partial Differential Equations”, 1999 SIAM Annual Meeting, Atlanta, May 12-15, 1999
- Workshop of the members of the Climbing Program of National Key Project of Foundation in China: The Finite Element Methods and its Theory, Beijing Institute of Applied Physics and Computational Mathematics, Beijing, April 1998.

b). Contributed

- Emerging Applications of the Nonlinear Schroedinger Equations, IPAM, Los Angeles, USA, February 3-7, 2003.
- International Conference on Scientific & Engineering Computation (IC-SEC) 2002, Singapore, December 3-5, 2002.
- International Conference on Scientific & Engineering Computing, Peking University, Beijing, China, March 19-23, 2001.
- Nonlinear Analysis: 2000, Courant Institute, New York University, May 28-June 2, 2000.

- Eighth International Conference on Numerical Combustion, Amelia Island, Florida, March 5-8, 2000.
- 99 International Conference on “Scientific and Engineering Computing for Young Chinese Scientists”, Beijing, July 1-4, 1999.
- Workshop on “Nonlinear PDE and Applications to Materials”, University of Minnesota, Minneapolis, April 30-May 2, 1999
- Workshop on Computation of Incompressible Viscous Flows, Beijing Institute of Applied Physics and Computational Mathematics, August 1998
- Workshop on Multiscale Analysis and Applications, Academia Sinica, Beijing, August 1997
- Grid Adaptation in Computational PDEs: Theory & Applications, ICMS (International Centre for Mathematics Sciences), Edinburgh, Scotland, July 1996.
- Mathematics of Finite Element methods and Applications (MAFLAP96), Brunel University, London, June 1996.

c). **Organized**

- Minisymposium on “The Nonlinear Schroedinger Equations: Analysis, Numerics and Applications” (with X.-P. Wang), ICIAM 2003: The 5th International Congress on Industrial and Applied Mathematics, July 7-11, 2003, Sydney, Australia.
- Minisymposium on “Modeling and Numerical Issues in Multi-scale Problems” (with J.F. Huang), SIAM 50th Anniversary and 2002 Annual Meeting, July 8-12, 2002, Philadelphia, USA.
- International Workshop on Computational Science and Engineering (with G.W. Wei et al.), 2 July 2001, NUS, Singapore.

GRANT SUPPORT:

- Principal Investigator, Ministry of Education & National University of Singapore, 2003-2005, S\$33,800 for “Quantized Vortex States and Dynamics in Bose-Einstein Condensate”.
- Principal Investigator, Ministry of Education & National University of Singapore, 2002-2004, S\$83,000 for “Numerical Simulation for Bose-Einstein Condensation (BEC)”.
- OAP (Fellow-Inbound) grant, NSTB & National University of Singapore, July 2003, S\$5,000 for Prof. J. Shen’s visit.

- Principal Investigator, Ministry of Education & National University of Singapore, 2001-2003, S\$55,500 for “Numerical Methods for Problems with Multiscale Phenomena”.
- OAP (Fellow-Inbound) grant, NSTB & National University of Singapore, 2002, S\$9,200 for Prof. H. Han’s visit.
- Principal Investigator, Climbing Program of National Key Project of foundation in China, 1997-1999, 60,000 yuan for “Finite Element Methods for Non-Newtonian/Viscoelastic flows”
- Principal Investigator, Cao Guang-Biao’s Higher Science and Technology Grant at Tsinghua University, 1998-1999, 50,000 yuan for “High-order Local Artificial Boundary Conditions for Partial Differential Equations in Unbounded Domains”.
- Co-Principal Investigator (with H. Han and J. Lu), National Natural Science Foundation in China, 1998-2000, 75,000 yuan for “Artificial Boundary Conditions for Incompressible Viscous Flows”
- Principal Investigator, The Scientific Research Foundation for the Returned Oversea’s Chinese Scholars, 1997-1999, 25,000 yuan for “Numerical Simulations of Non-Newtonian/Viscoelastic flows”.

PROFESSIONAL SERVICES:

- Member of Editorial Board, Chinese Journal of Numerical Methods and Applications, July 2000 –
- Mathematical Review Reviewer, April 2001 –
- Department of Computational Science (NUS) Colloquium Coordinator, January 2001 –
- Department of Computational Science (NUS) UROPS Coordinator, January 2001 –

AWARD:

- Beijing Science and Technology Award, 2003 (AWARDED TO RESEARCHER FOR SIGFICIENT ACHIEVEMENT IN SCIENCE AND TECHNOLOGY PROGRESS IN BEIJING).
- The Young Researcher Fellowship Award, 2001, The First M.I.T. Conference on Computational Fluid and Solid Mechanics, Massachusetts Institute of Technology, USA.
- Tsinghua Alumni Award, Tsinghua University, 1995, 1997

- Luokeng Hua Scholarship, Tsinghua University, 1994 (AWARDED ANNUALLY TO THE TOP RESEARCH STUDENT IN APPLIED MATHEMATICS IN School of Science at Tsinghua)
- C. C. Lin Scholarship, Tsinghua University, 1995 (AWARDED ANNUALLY TO THE TOP RESEARCH STUDENT IN APPLIED MATHEMATICS IN TSINGHUA UNIVERSITY)

Msc. & PH. D. ADVISERS:

- Yanzhi Zhang, National University of Singapore, January 2003 –
- Yunyi Ge, National University of Singapore, July 2002 –
- Hanquan Wang, National University of Singapore, July 2002 –
- Fangfang Sun, National University of Singapore, July 2001– June 2003.
- Wenjun Ying, Tsinghua University, graduated with M.S. in June 2000, co-supervised with H. Han.

REFEREEING SERVICES:

- Numerical Methods for Partial Differential Equations
- Journal on Communications in Mathematical Sciences
- IMA Journal on Numerical Analysis
- Journal of Computational Physics
- Mathematical Models and Methods in Applied Sciences
- Applied Mathematics Letters
- Journal of Computational Mathematics
- Chinese Journal of Computational Physics
- International Journal of Numerical Methods in Fluids
- Journal of Scientific Computing

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