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**FORMAL EDUCATION:**

- Ph.D. Mathematics, Courant Institute of Mathematical Sciences, NYU, 1976
- M.S. Computer Science/Mathematics, Courant Institute, NYU, 1974
- B.S. Physics, Tulane University, 1972 (cum laude with Honors)
- B.S. Mathematics, Tulane University, 1972 (cum laude with Honors)

**THESIS:** “The Method of Lines Solution of Partial Differential Equations,” written under the guidance of Prof. Peter D. Lax.

**RESEARCH INTERESTS:** My research in applied mathematics and the numerical solution nonlinear partial differential equations has been to advance our understanding of fluid dynamics, nonlinear waves, and modeling biological systems, including the spread of infectious diseases. Recently, I have focused on creating and analyzing mathematical models based on the underlying transmission mechanisms of diseases to help the medical/scientific community understand and anticipate the spread of an epidemic and to optimize the impact of prevention strategies on disease transmission.

**EMPLOYMENT HISTORY:**

- 1998-Present Los Alamos DOE Office of Science ASCR Program Manager
- 1985–2008 Group Leader, LANL Mathematical Modeling and Analysis Group T-7.
- 1988–Present Adjunct Professor of Mathematics, University of Arizona.
- 1986–1988 Administrative Manager, LANL Advanced Computing Facility.
- 1982–Present Executive Council, Center for Nonlinear Studies, LANL.
- 1982–1983 Associate Chair, Center for Nonlinear Studies, LANL.
- 1980–1985 Deputy Group Leader, LANL Mathematical Modeling and Analysis.
- 1976–Present Research Staff, LANL, Mathematical Modeling and Analysis.
- 1972–1976 Research Assistant, Courant Institute of Mathematical Sciences, NYU.
- 1975–Summer Los Alamos Scientific Laboratory, digital image enhancement.
- 1974–Summer Los Alamos Scientific Laboratory, mathematical immunology.
- 1972–Summer Lawrence Livermore Laboratory, atmospheric pollution.

## CURRENT and PAST ACTIVITIES:

- 2008–Present Chair Nomination Committee for Nonlinear Waves and Coherent Structures  
SIAM Activity Group
- 2008–Present Organizing Committee for the ASCR Applied Mathematics PI meeting  
2007–2008 Chair Director Search Committee for the NSF Institute for Pure and Applied Mathematics
- 2007–Present Member Canadian Mathematics of Information Technology and Complex Systems (MITACS) Board of Trustees
- 2006–Present Member Tulane University Science and Engineering Advisory Board
- 2005–Present Chair NSF Center IPAM Board of Trustees
- 1998–Present SIAM Committee on Science Policy (Chair 2004-2005)
- 1993–Present Editor of the International J. of Computers and Mathematics
- 1990–Present Editor of the SIAM J. on Scientific Computing
- 1989–Present Editor for International Journal of High-Speed Computing
- 2006–Present Editor-in-Chief SIAM Frontier Book Series
- 2005–2006 Past President, Society for Industrial and Applied Mathematics (SIAM)
- 1998–2006 Member of the SIAM Council
- 2002–2006 Member of the Council of Scientific Society Presidents
- 1998–2006 Member of the SIAM Systems Oversight committee
- 2003–2004 President, Society for Industrial and Applied Mathematics (SIAM)
- 2003–2005 Chair of the SIAM Council
- 1999–2005 Editor of the SIAM J. Multiscale Modeling and Simulation
- 2001 Co-Chair of the IMA Special Year on Mathematics in the Geosciences
- 1998–2002 Vice President of the Society for Industrial and Applied Mathematics (SIAM) for Publications
- 1996–2000 Member of the Scientific Program Advisory Committee for the NSF Institute for Mathematics and its Applications
- 1998–2002 Chair of the SIAM Board of Editors-in-Chief
- 2001 Co-Chair of the SIAM 2001 Annual Meeting
- 2000 Co-organizer with Misha Shashkov, Joel Dendy, Len Margolin, Blair Swartz for the Conference on Systems of Conservation Laws and Related Topics
- 1999 Co-organizer with James Cavendish for the NSF/IMA Conference on Decision Making under Uncertainty: Assessment of the Reliability of Mathematical Models
- 1999 Co-organizer with David Sharp, Shiyi Chen, Sallie Keller-McNulty, Len Margolin, and Timothy Trucano for the DOE Workshop on Predictability of Complex Phenomena
- 1999 Co-organizer for the II PanAmerican Workshop: Applied and Computational Mathematics
- 1999 Co-organizer with Shiyi Chen and Weinan E for the CNLS Workshop on Incompressible Fluid Flows: Numerical Methods and Applications

1998–2001 SIAM Vice President for Publications  
 1998–2000 Member of the SIAM Community Lecture Series Committee  
 1998–Present Member of the SIAM Systems Oversight Committee  
 1997 Organizer/Chair CNLS Conference on Nonlinear Waves and Solitons in Physical Systems  
 1997–1999 Member of the SIAM Compensation Committee of the Board  
 1995–1998 Member of the Council of the AMS  
 1995–1996 Member of the Committee on Education of the AMS  
 1995–1996 AMS Committee on Publications  
 1996–1998 AMS Committee on Meetings and Conferences  
 1995 Member of NSF Committee on Visitor Review Panel for the New Technologies Program  
 1995 Co-organizer with Misha Shashkov on CNLS Workshop using Knowledge Engineering and Computer Algebra to Write Complex Computer Programs  
 1995 Co-organizer with P. Deift, P. Holmes, D. Levermore, D. McLaughlin and E. Wayne for the Annual AMS-SIAM Summer Program: Dynamical Systems and Probabilistic Methods for Nonlinear Waves  
 1993 Co-Organizer/Chair with D. Holm and W. Newman of the CNLS Annual Conference on Modeling the Forces of Nature  
 1993–1999 Member of the Board of Trustees for SIAM  
 1992–1999 Editor-in-Chief of the SIAM J. on Scientific Computing  
 1992–1994 Chair of the Joint AMS-SIAM Committee on Applied Mathematics  
 1992–1994 Member of the AMS Task Force on Education, Industry, & Government Interactions  
 1992–1995 Member of the Board of Governors for the NSF Institute for Mathematics and its Applications  
 1992 Organizer/Chair of the SIAM, Annual Conference 1992  
 1991 Organizer/Chair of CNLS Annual Conference on Experimental Mathematics: Computational Issues in Nonlinear Science  
 1990 Co-Organizer/Chair with D. Campbell and R. Ecke of the CNLS Annual Conference on Nonlinear Science: The Next Decade  
 1989 Co-organizer with J. R. Buchler of the NATO Advanced Research Workshop on the Modeling of Nonlinear Stellar Pulsations  
 1988–1992 National Academy of Sciences NRC/NIST Panel for Computing and Applied Mathematics  
 1988–1991 Vice-chair of Society of Industrial and Applied Mathematics Special Interest Group in Supercomputing  
 1988–1992 SIAM Committee on Committees and Appointments  
 1988–1991 Treasurer of SIAM Special Interest Group on Dynamical Systems  
 1987–1995 Editor for International Journal of Supercomputer Applications  
 1987–1991 Mathematical Association of America State of the OSTP Workshop to develop recommendations for a National Scientific Effort on AIDS Modeling and Epidemiology  
 1987 Co-chair with Ann Stanley for CNLS Conference on Nonlinear Systems of Parabolic PDEs

- 1986 Ten-hour lecture series on “Blending Analysis and Numerics for Solving PDEs,” University of California Summer School on “ Experimental Mathematics: Computation and Discovery in Nonlinear Science ”
- 1982–1985 National Academy of Sciences Committee on Applications of Mathematics. Co-authored the Committee’s report Computational Modeling and Mathematics Applied to the Physical Sciences
- 1984 Co-chair, AMS-SIAM two-week Summer Seminar on Systems of Non-linear Partial Differential Equations
- 1983 Co-chair, CNLS Conference on Implicit Methods for PDEs
- 1982 Co-chair with R. Kirkpatrick and B. Sitt, CEA/Los Alamos meeting on Hydrodynamic Shock Waves and Instabilities
- 1981 Chair, CNLS Adaptive Mesh Methods Conference, Los Alamos

Referee for professional journals and granting agencies: J. Comp. Phys., SIAM J. Sci. and Stat. Comp., SIAM J. Num. Anal., AIAA, Phys. of Fluids, Phys. Lett. A., NSF, DOE-BES/AMS, ARO, AFOSR, and NIH.

## PUBLICATIONS AND SELECTED REPORTS:

### Books Edited:

1. **Statistical Estimation Approaches in Epidemiology**, editor with G. Chowell, N. Hengartner, L. Bettencourt, and C. Castillo-Chavez, to appear Springer Press (2008)
2. **An Introduction to Forward and Backward Sensitivity Analysis**, with L. Arriola, Los Alamos book preprint (2008).
3. **Method of Lines**, editor with T. Taha, L. Petzold, and W. Schiesser, Elsevier Science B (2001). Published as a special issue of Mathematics and Computers in Simulation 56 (2001).
4. **Nonlinear Waves and Solitons in Physical Systems**, editor with R. Camassa and B. Luce, North-Holland, North-Holland (1998). Also published as a special issue of Physica **D 123** (1998).
5. **Modeling the Forces of Nature**, editor with R. Camassa and W. Newman, North-Holland, 1994. Also published as a special issue of Physica **D 77** (1994).
6. **Experimental Mathematics: Computational Issues**, in Nonlinear Science, North-Holland (1992). Also published as a special issue of Physica **D** (1992).
7. **Nonlinear Science: The Next Decade**, with D. Campbell and R. Ecke, North-Holland (1991). Also published as a special issue of Physica **D** (1991).
8. **Nonlinear Systems of Partial Differential Equations in Applied Mathematics Part 2**, with D. D. Holm and B. Nicolaenko, Lectures in Applied Mathematics, Vol. **23**, Vol. **I**, American Mathematical Society, Providence, RI (1986).

9. **Nonlinear Systems of Partial Differential Equations in Applied Mathematics Part 1**, with D. D. Holm and B. Nicolaenko, Lectures in Applied Mathematics, Vol. **23**, Vol. **II**, American Mathematical Society, Providence, RI (1986).

**Research Publications:**

(Recent papers available at <http://math.lanl.gov/~mac> )

1. "Epidemic Models with Differential Susceptibilities and Disease Progression Rates," with Jia Li, to appear J. of Molecular Biology and Evolution (2008)
2. "Improving the Damage Accumulation in a Biomechanical Bone Remodeling Model," with J. M. Restrepo R. Choksi Yi Jiang. to appear in Computer Methods in Biomechanics and Biomedical Engineering (2008)  
item "Modeling the Influence of Polls on Elections," with J. M. Restrepo and R. Rael, in review (2008)
3. "Sensitivity Analysis for Quantifying Uncertainty in Mathematical Models," with Leon Arriola. to appear in **Statistical Estimation Approaches in Epidemiology**, (2008)
4. "Learning from the Past to Prepare for the Future: Modeling the Impact of Hypothetical Interventions During the Great Influenza Pandemic of 1918," with G. Chowell, N.W. Hengartner, and C.E. Ammon, CHANCE 21(2) , 55-60 (2008)
5. "Determining Important Parameters in the Spread of Malaria Through the Sensitivity Analysis of a Mathematical Model," with Nakul Chitnis, and J. M. Cushing. Bulletin of Mathematical Biology, (2008) 70: 12721296
6. "Spatial and Temporal Dynamics of Dengue Fever in Peru: 1994-2006," with G. Chowell, to appear in Epidemiology and Infection (2008)
7. "Accelerating Markov Chain Monte Carlo Simulation From Self-Adaptive Differential Evolution with Randomized Subspace Sampling," with Jasper A. Vrugt, Cajo J.F. ter Braak, Cees G.H. Diks, Bruce A. Robinson, and Dave Higdon, to appear in Water Resources Research (2008)
8. "Treatment of Input Uncertainty in Hydrologic Modeling Using Adaptive Markov Chain Monte Carlo Sampling," with Jasper A. Vrugt, Cajo J.F. ter Braak, Martyn P. Clark, and Bruce A. Robinson, to appear in Stochastic Environmental Research and Risk Assessment (2008)
9. "A Universal MultiMethod Search Strategy for Computationally Efficient Global Optimization," with Jasper Vrugt and Bruce Robinson, in review (2008),
10. "Analytical Effective Coefficient and First-Order Approximation for Linear Flow through Block Permeability Inclusions," with R. Sviercoski and Bryan J. Travis. Computers and Mathematics with Applications; May 2008; vol.55, no.9, p.2118-33

11. "The role of roads in the geo-temporal progression of the 2006 Nigerian avian influenza (H5N1) epidemic," with A. L. Rivas, G. Chowell, S. J. Schwager, F. O. Fasina, S. D. Smith, L. M. Bettencourt, A. L. Hoogesteijn, K. L. Anderson, and S. P.R. Bisschop. in review (2008)
12. "Diagnostic Delays and Dengue Fever in Colima, Mexico (2002)," with Gerardo Chowell, Porfirio Daz-Duenas, Diego Chowell, Sarah Hews, Gabriel Ceja-Espritu, and Carlos Castillo-Chavez, to appear Dengue Bulletin of the World Health Organization (2008)
13. "Modeling the Spread of Foot-and-Mouth Disease," with G. Chowell, T. Kostova, A. L. Rivas, in review (2008)
14. "Spatial and Temporal Dynamics of Dengue Fever in Peru: 1994-2006," with G. Chowell, to appear in Epidemiology and Infection (2008)
15. "A Strategy for Detecting Extreme Eigenvalues Bounding Gaps in the Discrete Spectrum of Self-Adjoint Operators," with J. Restrepo and M. Hasson; Computers and Mathematics with Applications; 2007; v.53, no.8, p.1271-1283
16. "Being Sensitive to Uncertainty," with L. Arriola; Computing in Science and Engineering; v.9, no.2, p.10-20 (2007).
17. "Multidimensional Compactons," with Rosenau, P; Phys. Rev. Letters. Jan 12 2007; v.98, no.2, p.024101
18. "Effective vaccination strategies for realistic social networks," with Miller, JC, Physica A: Statistical Mechanics and its Applications; 15 Dec. 2007; vol.386, no.2, p.780-5
19. "Level Set, Finite Volume Approximation of Shoaling Water Waves," with J. Barber, J.M. Restrepo and R. Camassa, in preparation (2007).
20. "A Hybrid Multiscale Method for Coupling Atomistic and Continuum Models," with Shengtai Li and Yi Sun Los Alamos National Laboratory Report (2007).
21. "Continuum Epidemic Models of Disease Spreading," with A.B. Aceves, T. Dohnal, I. Gabbitov; Los Alamos National Laboratory Report (2007).
22. "H5N1 avian influenza spread along roads in Nigeria," with Ariel L. Rivas, Gerardo Chowell, Steven J. Schwager, Folorunso O. Fasina, Stephen D. Smith, Almira L. Hoogesteijn, Kevin L. Anderson; (2007) in review
23. "Estimation of the reproduction number of dengue fever from spatial epidemic data," G. Chowell, P. Diaz-Duenas, J.C. Miller, P.W. Fenimore, J.M. Hyman, C. Castillo-Chavez. Math. Biosci. 2007 Aug;208(2):571-89
24. "Infection-Age Structured Epidemic Models with Behavior Change or Treatment," with J. Li, J of Biological Dynamics, v.1, no.1 p.109-131 (2007)

25. "Estimating the reproduction number from the initial phase of the Spanish flu pandemic waves in Geneva Switzerland," with Chowell, G; Ammon, CE; Hengartner, NW; *Mathematical Biosciences and Engineering*; JUL 2007; v.4, no.3, p.457-470
26. "Mixing Patterns Between Age Groups Using Social Networks," with S. Del Valle, S. Eubank, and H. Hethcote; *Social Networks*, (2007) v. 29 539-554
27. "Principles of Mimetic Discretizations of Differential Operators," Pavel B. Bochev and James M. Hyman, *IMA Vol. Math. and its Appl*; 2006; v.142, p.89-119, LAUR 05-4244
28. "Mathematical applications associated with the deliberate release of infections agents," with G. Chowell, S. Del Valle, F. Sanchez, B. Song, and Carlos Castillo-Chavez. *AMS Cotemp. Math. Series Vol. 410*, pp. 73-87. Gumel A. (Chief Editor), Castillo-Chavez, C., Clemence, D.P. and R.E. Mickens, pp. 51-72. (2006)
29. "Critical response to post-outbreak vaccination against foot-and-mouth disease," with G. Chowell, A. L. Rivas, N. W. Hengartner, and C. Castillo-Chavez; **Modeling in The Dynamics of Human Diseases: Emerging Paradigms and Challenges**. *AMS Cotemp. Math. Series Vol. 410*, pp. 73-87. Gumel A. (Chief Editor), Castillo-Chavez, C., Clemence, D.P. and R.E. Mickens. (2006)
30. "Modeling the transmission dynamics of Acute Hemorrhagic Conjunctivitis: Application to the 2003 Outbreak in Mexico," G. Chowell, E. Shim, F. Brauer, P. Diaz-Duenas, J. M. Hyman, C. Castillo-Chavez; *Stat. Med.* 25(11), 1840-1857 (2006)
31. "Identification of case clusters and counties of greater infective connectivity in the 2001 Uruguayan foot-and-mouth disease epidemic," G. Chowell, A. L. Rivas, S.D. Smith, J. M. Hyman; *Am. J. Vet. Res.* 67(1), 1-12 (2006)
32. "The Role of Spatial Mixing in the Spread of Foot-and-Mouth Disease," G. Chowell, A. L. Rivas, N. W. Hengartner, J. M. Hyman, C. Castillo-Chavez; *Prev. Vet. Med.* 73, 297-314 (2006)
33. "Human-mediated foot-and-mouth disease epidemic dispersal: disease and vector clusters," A. L. Rivas, B. Kunsberg, G. Chowell, S. D. Smith, J. M. Hyman, S. J. Schwager; *J. Vet. Med. B* 53, 1-10 (2006)
34. "Differential susceptibility and differential infectivity epidemic models," with J. Li, *Math Biosciences and Engineering*, Vol. 3, 89-100, (2006)
35. "Transmission Dynamics of the Great Influenza Pandemic of 1918 in Geneva, Switzerland: Assessing the Effects of Hypothetical Interventions," with G. Chowell, C. Ammon, N. Hengartner, *Journal of Theoretical Biology*; JUL 21 2006; v.241, no.2, p.193-204 .
36. "Estimation of the reproduction number of the Spanish Flu Epidemic in Geneva, Switzerland," with G. Chowell, C. Ammon, N. Hengartner, *Proceedings of the Second European Influenza Conference (St-Julians, Malta, September, 2005)*. *Vaccine* 24, 6747-6750 (2006) 2005

37. "Applications of Algebraic Topology to Compatible Spatial Discretizations," P.B. Bochev and J.M. Hyman, Five-Laboratory Conference on Computational Mathematics Proceedings, Vienna, June 2005
38. "Targeted Vaccination in a Social Network Epidemic Model," with J. Miller, Los Alamos National Laboratory Report (2005).
39. "Effects of Behavioral Changes in a Smallpox Attack Model," with S. Del Valle, H. Hethcote, and C. Castillo-Chavez, *Mathematical Biosciences* 195 (2005) 228-251.
40. "Differential susceptibility epidemic models," with J. Li, *J. of Math Bio*, June 2005, v.50, no.6, p.626-644
41. "Bifurcation Analysis of a Mathematical Model for malaria Transmission," with N. Chitnis, J.M. Cushing, Submitted to *SIAM J Applied Math* (2005)
42. "The reproductive number for an HIV model with differential infectivity and staged progression," with J.Li, *Linear Algebra and its Applications*, Mar 2005; v.398, p.101-116
43. "Epidemiological models for mutating pathogens," with J. Li, Y.C. Zhou, Z. Ma, *SIAM J on Applied Mathematics*, 2005, v.65, no.1, p.1-23
44. "Modeling the 2001 Foot-and-Mouth Epidemic in Uruguay using Geo-referenced Data," with G. Chowell, A/L. Rivas, N.W. Hengartner, C. Castillo-Chavez, Submitted to *Preventive Veterinary Medicine* 2005.
45. "Identification of case clusters and counties of greater infective connectivity in the 2001 Uruguayan foot-and-mouth disease epidemic," with G. Chowell, A. L. Rivas, and S.D. Smith, *American J. of Veterinary Research*. 67(1), 1-12 (2005)
46. "Predicting scorpion sting incidence in an endemic region using climatological variables," with G. Chowell, P. Diaz-Duenas, N. W. Hengartner, *International J of Environmental Health Research*. 15(6), 425-435 (2005)
47. "Patch dynamics for multiscale problems," *Computing in Science and Engineering*; May-June 2005; vol.7, no.3, p.47-53
48. "Achieving Brouwer's law with high-order Stormer multistep methods," with K.R. Grazier, W.I. Newman, David J. Goldstein, Philip W. Sharp, to appear *Australian and New Zealand Industrial and Applied Mathematics J* 46(E) pp.C101–C119, 2005.
49. "Long Simulations of the Solar System: Brouwer's Law and Chaos," with K.R. Grazier, W.I. Newman, and P.W. Sharp. In review *Australian and New Zealand Industrial and Appl. Math. J.* (2005)
50. "Brouwer's Law: Optimal Multistep Integrators for Celestial Mechanics," with K.R. Grazier, W..I Newman, D.J. Goldstein, and P.W. Sharp. In review *Australian and New Zealand Industrial and Appl. Math. J.* (2005)

51. "Non-Adjoint Sensitivity Analysis of Initial Value Problems," with L. Arriola, Los Alamos National Laboratory Report (2005)
52. "The Reproductive Number of Ebola and the Effects of Public Health Measures: The cases of Congo and Uganda," with G. Chowell, N. W. Hengartner, C. Castillo-Chavez, and P. W. Fenimore, *J. Theor. Biol.* 229(1), 119-126 (2004).
53. "Model Parameters and Outbreak Control for SARS," with G. Chowell, C. Castillo-Chavez, P.W. Fenimore, C. Kribs-Zaleta, and L. Arriola, *Emerg. Inf. Dis.* 10 (7) (2004) p.1258-1263
54. "A numerical study of the exact evolution equations for surface waves in water of finite depth," with Y.A. Li, W.Y. Choi, *Studies in Applied Math*, Oct 2004, v.113, no.3, p.303-324
55. "The convergence of mimetic discretization for rough grids," with S. Steinberg, *Computers and Mathematics with Applications*; 2004; vol.47, no.10-11, p.1565-610
56. "Epidemiological Models with Virus Strains Mutation and Hopf Bifurcation," with J. Li, Y. Zhou, and Z. Ma, *SIAM J. Appl. Math.* Vol. 65, No. 1, pp. 1-23 (2004)
57. "Infection-Age Structured Epidemic Models with Behavior Change or Treatment," with J. Li, in review *J. of Math. Biology*
58. "An Age-Structured Model of HIV infection that allows for the variations in the production rate of viral particulates and the death rate of productively infected cells," with P. W. Nelson, M. A. Gilchrist, D. Coombs, and A. S. Perelson, *Math Biosciences and Engineering*, Vol. 1, No. 2, 267-288 (2004)
59. "Computer arithmetic for probability distribution variables," with W.Y. Li, *Reliability Engineering and System Safety*, Jul-Sept 2004, v.85, no.1-3, p.191-209
60. "Non-Adjoint Sensitivity Analysis of Initial Value Problems," with L. Arriola, Submitted for publication *Mathematical Association of America Monthly.* (2004)
61. "The geographic spread of an infectious agent between the major cities in the US," with Tara LaForce, *Mathematical Modeling Applications in Homeland Security*, SIAM Pub. p. 215-240 (2003), T. Banks and C. Castillo-Chavez (Eds.)
62. "Solution adapted mesh refinement and sensitivity analysis for parabolic partial differential equation systems," with S.T. Li and L.R. Petzold, *Lecture Notes in Computational Science and Engineering*, 2003, v.30, p.117-132
63. "Modeling the impact of random screening and contact tracing in reducing the spread of HIV," with J. Li and E.A. Stanley, *Mathematical Biosciences*, 2003, v.181, no.1, p.17-54
64. "An Adaptive Moving Mesh Method with Static Rezoning for Partial Differential Equations," with S. Li and L. Petzold, *Comp. Math. with Appl.*, **46**, (2003), pp. 1511-1524.

65. “Scaling laws for the movement of people between locations in a large city,” with G. Chowell, S. Eubank and C. Castillo-Chavez, *Phys. Rev. E*, **68** (6) (2003) pp. 17-54.
66. “Differential Susceptibility Epidemic Models,” with J. Li, in review, *J. of Math. Biology* (2003).
67. “High-Order Multistep and Runge Kutta Methods for the Numerical Solution of Stochastic PDEs,” with M. Cliff, Los Alamos Report (2002).
68. “Mimetic finite difference methods for diffusion equations,” with J. Morel, M. Shashkov and S. Steinberg, *Computational Geosciences* **6**, (2002), pp. 333-352.
69. “Mimetic Finite Difference Operators for Second-Order Tensors on Unstructured Grids,” with J. C. Campbell and M. J. Shashkov, *Computers Math. with Applications*, **44** (2002) 157-173.
70. “Mimetic Finite Difference Methods for Maxwell’s Equations and the Equations of Magnetic Diffusion,” with M. Shashkov, *Prog. in Electromagnetic Research, PIER* **32**, (2001), 89-121.
71. “The Effect of Inner Products for Discrete Vector Fields on the Accuracy of Mimetic Finite Difference Methods,” with M. Shashkov, and S. Steinberg, *Computers Math. with Applications*, **42**, No. 12, 1527-1548, (2001).
72. “Compacton Solutions in a Class of Generalized Fifth-Order KdV Equations,” with F. Cooper and A. Khare, *Phys. Rev. E*, **6402**, No. 2.2, 6608- (2001).
73. “Mimetic Finite Difference Methods for Maxwell’s Equations and the Equations of Magnetic Diffusion,” with M. Shashkov, *J. of Electromagn. Waves and Appl.*, Vol. 15, No. 1, 107-108 (2001).
74. “Fourth and Sixth-Order Conservative Finite Difference Approximations of the Divergence and Gradient,” with J. Castillo, M. Shashkov, and S. Steinberg, *Appl. Numerical Math.*, **37** (2001), 171-187.
75. “The Initialization and Sensitivity of Multigroup Models for the Transmission of HIV,” with J. Li and E. A. Stanley, *J. Theor. Biology* **208**, No. 2, (2001) 227-249
76. “The origin of acquired immune deficiency syndrome: Darwinian or Lamarckian?,” with T. Burr, and G. Myers, *Phil. Trans. R. Soc. Lond.* **B** (2001) **356**, 877-887.
77. “Stability, Relaxation, and Oscillation of Bidegradation Fronts,” with J. Xin, *SIAM J. Appl. Math.* **61** (2000), no. 2, 472-505
78. “An Algorithm to Align a Quadrilateral Grid with Internal Boundaries,” with S. Li, P. Knupp and M. Shashkov, *J. Comp. Physics*, **163**, No. 1, (2000) 133-149

79. "Impacts of Misspecifying the Evolutionary Model in Phylogenetic Tree Estimation," with T. Burr, and G. Myers, and A. Skourikhine, Proceedings of the International Conference on Mathematics and Engineering Techniques in Medicine and Biological Sciences, pp. 481-487 (2000)
80. "An Intuitive Formulation for the Reproductive Number for the Spread of Diseases in Heterogeneous Populations," with J. Li, Math. Biosciences **167**, No. 1, (2000) 65-86
81. "Sensitivity Studies of the Differential Infectivity and Staged Progression Models for the Transmission of HIV," with J. Li and E. A. Stanley, Los Alamos Report LA-UR-99-2253 (1999).
82. "Dynamical Evolution of Planetesimals in the Outer Solar System. II. The Saturn/Uranus and Uranus/Neptune Zone," with K. R. Grazier, W. I. Newman, and W. M. Kaula, ICARUS **140**, 353-368 (1999).
83. "Dynamical Evolution of Planetesimals in the Outer Solar System. I. The Jupiter/Saturn Zone," with K. R. Grazier, W. I. Newman, and W. M. Kaula, ICARUS **140**, 341-352 (1999).
84. "Mimetic Discretizations for Maxwell's Equations," with M. Shashkov, J. of Comp. Physics. **151**, No. 2, 881-909 (1999)
85. "An Adaptive Moving Mesh Method with Static Rezoning for Partial Differential Equations," with S. Li and L. R. Petzold, Los Alamos Report LA-UR-98-5465 (1999)
86. "Interactive and Dynamic Control of Adaptive Mesh Refinement," with S. Li, Los Alamos Report LA-UR-98-5462 (1999), in review.
87. "An Adaptive Mesh Refinement Method for Two Dimensional PDEs," with S. Li, Los Alamos Report LA-UR-98-5463 (1998)
88. "An Adaptive Moving Mesh Method with Locally Refined Nested Grids for PDEs," with S. Li, Los Alamos Report LA-UR-98-5460 (1999)
89. "The Differentiated Infectivity and Staged Progression Models for the Transmission of HIV," with J. Li and E. A. Stanley, Mathematical Biosciences **155**, no. 2 (1999) 77-109
90. "The Orthogonal Decomposition Theorems for Mimetic Finite Difference Methods," with M. Shashkov, SIAM J on Numerical Analysis, **36**, No. 3, (1999) 788-818
91. "Nonlinear Waves and Solitons in Physical Systems," with R. Camassa and B. Luce, Physica D **123** no. 1-4, (1998) 1-20
92. "Pulsating Multiplet Solutions of Quintic Wave Equations," with P. Rosenau, Physica D **123** (1998) 502-512

93. "Mimetic Discretizations for Maxwell's equations and the equations of magnetic diffusion," with M. Shashkov, *Mathematical and Numerical Aspects of Wave Propagations*, J. A. DeSanto, ed., (SIAM, Philadelphia, 1998), 561-563.
94. "The Approximation of Boundary Conditions for Mimetic Finite Difference Methods," with M. Shashkov, *Computers and Mathematics with Applications*, **36**, no. 5, 79-99, (1998).
95. "The Black Box Multigrid Numerical Homogenization Algorithm," with J. E. Dendy, Jr. and J. D. Moulton, *J. of Comp. Physics*, **142**, 80-108 (1998)
96. "Modeling the Effectiveness of Isolation Strategies in Preventing STD Epidemics," with J. Li, *SIAM Journal of Applied Mathematics*, **58**, no. 3, 912-913 (1998).
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### **OTHER REPORTS:**

Co-authored 43 Los Alamos Classified reports on analytical and numerical methods analyzing shock waves in non-weapons inertial fusion systems. Most are joint with S. A. Colgate.

Equations,” **SELECTED COMPUTER CODES:**

MOL1D (1976) General purpose method of lines subroutine package for the solution of systems of initial boundary value partial differential equations in one space dimension; FORTRAN - 4,200 lines.

PDE1D (1978) Fully vectorized general purpose explicit PDE package for solving hyperbolic systems of initial value problems. These routines are much faster than MOL1D and require one-third the memory; FORTRAN - 1,200 lines.

PDE2D (1979) 2-D version of PDE1D; FORTRAN - 2,200 lines.

PLT1T (1979) High-level interactive graphics plotting package for the Tektronix series 40XX terminals; FORTRAN - 1,800 lines.

PDE1A (1980) Revision of PDE1D that accommodates adaptive meshes and highly interactive graphics; FORTRAN - 3,800 lines.

EOSMOD (1981) with M. Klein, High-level interface for interpolating the SESAME equations-of-state and opacity tables; FORTRAN - 3,500 lines.

DERMOD (1981) Vectorized subroutine package for the numerical differentiation of functions defined on a discrete mesh in 1, 2, and 3 dimensions using finite differences (with B. Larrouturou); Fourier and Chebyshev pseudospectral methods (with R. Dougherty); and finite volume methods (with C. Scovel); FORTRAN - 12,000 lines.

FORSIG (1981) A preprocessor and arithmetic library for an extension of FORTRAN that can account for the creation and propagation of errors in a computer program due to uncertainties in the data; SNOBOL - 700 lines; FORTRAN - 1,100 lines.

RWMOD (1983) (with R. Hayes) A portable input/output package to read or write 1, 2, and 3-dimensional arrays in a formatted or unformatted style; FORTRAN - 1,300 lines.

PLTN (1983) (with R. Dougherty) An interactive color plotting package to display multiple lines, contours, surfaces, grids, streamlines, and velocity vectors using the NCAR plotting routines; FORTRAN - 9,000 lines.

1 1/2-D Code (1977–1988) A sophisticated interactive computer program to approximate multimaterial fluid flows in a variable area cylindrical pipe system. The code is Lagrangian in  $r$  and Eulerian in  $z$  and makes extensive use of the EOSMOD, DERMOD, PDE1A, RWMOD, PLT1T, and PLTN packages; FORTRAN - 3,000 lines (31,000 lines when assembled).

ODEUM (1984) Automatic implementation of new temporal integration of numerical methods into a variable time step/variable order integration package for solving PDE's. The ODESA subpackage(written with L. MacNeil) provides sophisticated stability and accuracy analysis of the multistep multicycle integration methods that can be implemented in ODEUM; ALTRAN - 1,700 lines, FORTRAN - 3,800 lines.

SSMD (1985) High-level Multitasking routines to assist in converting FORTRAN programs to run on multiprocessing computers (with R. Dougherty); FORTRAN - 600 lines.

AIDS (1987) Simulation of the spread of the AIDS virus in a risk-based biased-mixing model of the U.S. homosexual population; FORTRAN - 4,000 lines.

DEMOM (1991) Automated solution of evolutionary partial differential equations in two and three space dimensions. FORTRAN - 13,000 lines.