

**VITA**  
**James Stanley Sochacki**

1. PRESENT WORK INFORMATION

Department of Mathematics and Statistics  
James Madison University  
Harrisonburg, Virginia 22807  
sochacjs@jmu.edu  
<http://educ.jmu.edu/~sochacjs/>  
(540) 568-6614

2. EDUCATION

- Ph.D., Mathematics, University of Wyoming, July 1985.
- M.S., Mathematics, University of Wyoming, July 1981.
- B.S., Mathematics, University of Michigan, with distinction, July 1979.

3. EXPERIENCE

- Professor, James Madison University, 2002–present.
- Associate Professor, James Madison University, 1994–2002.
- Assistant Professor, James Madison University, 1988–1994.
- Visiting Science Professor, University of Wyoming, 1/91–8/92.
- NSF Mathematics Consultant, University of Wyoming, 7/88–8/88.
- Visiting Assistant Professor, University of California, Davis, 7/85–6/88.
- Geophysics Consultant, University of Wyoming, 7/86–8/86.
- Correspondence Instructor, University of Wyoming, 9/81–9/83.
- Graduate Assistant, University of Wyoming, 9/79–8/85.

4. PROFESSIONAL SOCIETIES

- American Mathematical Society.
- Mathematical Association of America.
- Society of Industrial and Applied Mathematics.

5. BRIEF HISTORY

I have developed many of the undergraduate courses in applied and computational mathematics at James Madison University (JMU). I directed the creation of the Center for Computational Mathematics and Modeling (CCMM) at JMU. The CCMM houses NSF funded parallel computers and a flat panel array parallel visualization computer system <http://www.jmu.edu/hyper/visualization>. The CCMM is to help foster undergraduate research in applied and computational mathematics. It is also a major component of the joint Computational Science program between the Departments of Mathematics and Physics at JMU and the Department of Mathematics and Computer Science at North Carolina Central University. I have directed many undergraduate research projects and am currently directing several undergraduate research projects. My main area of research is in the numerical solutions of ordinary and partial differential equations and mathematical modeling.

I am also the course scheduler for the Department of Mathematics and Computer Science. I also serve on the Institute for Visual Studies board and am a co-director.

## 6. COURSES DEVELOPED AT JMU

- MATH 238. Linear Algebra with Differential Equations
- MATH 248. Computers and Numerical Algorithms
- MATH/PHYS 265. Introduction to Fluid Mechanics
- MATH 337. Methods of Applied Calculus
- MATH 340. Mathematical Modeling I - Optimization
- MATH 341. Mathematical Modeling II - Dynamical Systems
- MATH 342. Mathematical Modeling in Biology
- MATH 360. Complex Variables with Applications
- MATH/PHYS 365. Introduction to Computational Fluid Mechanics
- MATH/FIN 395. Mathematical Finance
- MATH/CS 448. Numerical Analysis
- MATH/CS 449. Numerical Analysis for Differential Equations

## 7. PUBLICATIONS

- James Sochacki, Polynomial Ordinary Differential Equations - Examples, Solutions, Properties. *Neural Parallel & Scientific Computations*, Volume 18, Issue 3-4, December 2010, pp. 441-450.
- David Carothers, G. Edgar Parker, James Sochacki, Debra Warne and Paul Warne, An Explicit A-Priori Error Bound for the Taylor Polynomial; Approximation to the Solution of Ordinary Differential Equations. *Computers and Mathematics with Applications*, Volume 52, Issue 12, December 2006, pp. 1695-1710.
- David Carothers, G. Edgar Parker, James Sochacki, Paul G. Warne, Some Properties of Solutions to Polynomial Systems of Differential Equations. *Electronic Journal of Differential Equations*, Vol. 2005, No. 41, pp. 1-18. April, 2005.
- James Liu, James Sochacki and Paul Dostert, Singular perturbations and approximations for integrodifferential equations, *Proceedings of the International Conference on Control and Differential Equations*, Lecture Notes in Pure and Applied Mathematics, Differential Equations and Control Theory, Vol. 225, (2002).
- Gerald Buetow and James Sochacki, Incorporating implied volatility into contingent claim valuation, *International Mathematics Journal*, Vol.1, No.5, 445-466, (2002).
- Gerald Buetow and James Sochacki, The tradeoffs between alternative finite difference techniques used to price derivative securities, *Applied Mathematics and Computation*, Vol. 115, Nos. 2-3, October 2000.
- Edgar Parker and James Sochacki, A Picard-McLaurin Theorem for Initial Value PDE's, *Abstract Analysis and its Applications*, Vol. 5, No. 1, (2000) 47-63.
- James Liu, Edgar Parker, James Sochacki and Aren Knutsen, Approximation methods for integrodifferential equations, *Proceedings of the International Conference on Dynamical Systems and Applications, III*, 383-390, (2001), (submitted May 1999).

- Gerald Buetow and James Sochacki, A more accurate finite difference approach to the pricing of contingent claims, *Applied Mathematics and Computation*, **91**, (1998), 111–126.
- Edgar Parker and James Sochacki, Implementing the Picard Iteration, *Neural, Parallel & Scientific Computations*, **4** March 1996, pp. 97-112.
- Gerald Buetow and James Sochacki, A finite difference approach to the pricing of options using absorbing boundaries, *Journal of Financial Engineering*, **4** (1995), 263–280.
- Richard Ewing, Derek Mitchum, Patrick O’Leary, Robert Sharpley and James Sochacki, Distributed computation of wave propagation models using PVM, *Parallel and Distributed Technology*, IEEE, Spring 1994, 26–31.
- Jiri Zahradnik, Patrick O’Leary, James Sochacki, Finite-difference schemes for elastic waves based on an integration approach, *Geophysics*, **56** (1994), 928-937.
- Tao Lin, James Sochacki, John George, and Richard Ewing, Some grid refinement schemes for hyperbolic equations with piece-wise constant coefficients, *Mathematics of Computation*, **56** (1991), 61–86.
- James Sochacki, Absorbing boundary conditions using regions with exponential decay, *Mathematical and Numerical Aspects of Wave Propagation Phenomena* (G. Cohen, I. Halpern, and P. Joly, eds.), SIAM Publications, Philadelphia, Pennsylvania, 1991, 292–303.
- Richard Ewing, Tao Lin and James Sochacki, Interface conditions for acoustic wave propagation, *Mathematical and Numerical Aspects of Wave Propagation Phenomena* (G. Cohen, I. Halpern, and P. Joly, eds.), SIAM Publications, Philadelphia, Pennsylvania, 1991, 303–313.
- James Sochacki, John George, Richard Ewing, and Scott Smithson, Interface conditions for acoustic and elastic wave propagation, *Geophysics*, February 1991.
- Absorbing boundary conditions for the elastic wave equations, *Applied Mathematics and Computation*, October 1988.
- Krzysztof Ostaszewski and James Sochacki, Gronwall’s Inequality and the Henstock Integral, *Journal of Mathematical Analysis and Applications*, December 1987.
- James Sochacki, John George, Robert Kubichek, W.R. Fletcher, and Scott Smithson, Absorbing boundary conditions and surface waves, *Geophysics*, January 1987.
- *An Analysis of the Continuous and Finite Difference Equations for Acoustic and Elastic Wave Phenomena*, Ph.D. Thesis, University of Wyoming, 1985. (Received “Outstanding Dissertation in the Physical Sciences” Award.)

## 8. INVITED TALKS

- Stephen Lucas, James Stanley Sochacki, Roger Thelwell, Paul Warne, 9th AIMS Conference Special Session 39: Polynomial Methods for Differential Equations and Dynamical Systems, Orlando, Florida, USA July 1 - 5, 2012.
- David C. Carothers, Stephen K. Lucas, G. Edgar Parker, Joseph D. Rudmin, James S. Sochacki, Roger J. Thelwell, Anthony Tongen, Paul G. Warne: Connections Between Power Series Methods and Automatic Differentiation, The 6th International Conference on Automatic Differentiation, Fort Collins, CO, July 23 - 27, 2012.
- The Newton Cannon Ball Problem is a Polynomial Problem, MAA MD-DC-VA Section, Spring 2011 Randolph-Macon College, Ashland, VA.
- The Mathematics of the Single Pendulum: What are the Physical Implications?. Neural, Parallel, and Scientific Computations Conference. Summer 2010, Atlanta, GA.
- Coupled and Un-coupled Ordinary Differential Equations: What is the implication? , Virginia Academy of Sciences Annual Meeting, with Nicholas Giffen ,Department of Mathematics, North Carolina State University, Spring 2010 Meeting. James Madison University.
- Two Interesting Differential Equations for Upper Level Students, MAA MD-DC-VA Section, Fall 2009 Meeting. Goucher College, Baltimore, Maryland.
- A Mathematical Consideration of the Single Pendulum, MAA MD-DC-VA Section Spring 2009 Meeting. University of Mary Washington. Fredericksburg, Virginia.
- Analytic Functions and Initial Value ODE's, MAA MD-DC-VA Section Spring 2008 Meeting. James Madison University.
- Polynomial differential equations and periodic solutions. MAA MD-DC-VA Section Spring 2005 Meeting. University of Virginia. April 2005.
- A Modified Newton Method. University of North Texas, October 30, 2004.
- Relevance of Classical Analysis in Modern Contexts: Theory and Application of Polynomial Projection. VA-MD-DC Sectional MAA Plenary Talk. Salisbury State University. with G. Edgar Parker. April 23, 2004.
- Modifications of the Picard, Newton and Pade Methods for Initial Value Problems. Texas A &M University. March 2004.
- Using Picard's Method to Analyze Chaotic Systems. The Chaos and Fractals Session. Phoenix, AZ. January 2004 MAA-AMS national meetings.
- 'National Science Foundation program opportunities for computational science.' The 2003 SuperComputing Conference. Phoenix, Az. November 16, 2003. Panelists: Steve Cunningham, Division of Undergraduate Education, National Science Foundation, James Sochacki, Center for Computational Mathematics and Modeling, James Madison University.

Abstract:

A number of National Science Foundation programs can support projects to develop computational science studies. The panelists will describe some of these programs and discuss how a particular computational science program was funded by NSF. The panelists will also discuss the way NSF proposals are reviewed in order to help prospective proposers create successful proposals.

- JMU's Computational Science Program. The National Science Foundation Division of Undergraduate Education (sponsoring informal presentations of new CCLI projects at the ACM SIGCSE conference <http://www.csc.vill.edu/sigcse2004/>). Norfolk, Va. with Dave Pruett, William Ingham, Dorn Peterson, Dave Pruett, Alade Tokuta, Debra Warne and Paul Warne. March 2003.
- Using Cauchy Products and Pade Expansions to Solve Initial Value Problem Ordinary Differential Equations in Maple, 2003 Maple Summer Workshop Conference with James Money, University of Kentucky and Paul Warne, James Madison University. June 2003.
- Newton's Method as an Initial Value Ordinary Differential Equation with Picard's Method. Spring 2003 Meeting of the MD-DC-VA Section of the MAA held April 11 and 12 at Norfolk State University, Virginia.
- Applying the Modified Picard Method in a Symbolic and Numeric Computing Environment. Fall 2002 Meeting of the MD/DC/VA Section of the MAA held November 1 and 2 at the University of Maryland in College Park, MD.
- Undergraduate computational science via computational fluid dynamics, with Dave Pruett, MAA Sectional Meeting, VMI University, April 21, 2001.
- A Nonlinear Acoustic Model Arising from Euler's Equations, Seminar on Numerical Analysis at Texas A&M, February 21, 2001.
- The Algebraic Structure of Projectively Polynomial Functions, with Edgar Parker, 18th Annual SEARCDE Conference, Auburn University, Oct. 16,1998
- Newton's Method Revisited, with Edgar Parker, 18th Annual SEARCDE Conference, Auburn University, Oct. 16,1998
- Machine Implementation of the Picard Process, with Edgar Parker, International Conference on Dynamical Systems and Applications, May 24, 1995 (refereed).
- Applying the Picard Iteration, with Edgar Parker, International Conference on Dynamical Systems and Applications, May 24, 1995 (refereed).
- The Von Koch Island and Riemann's Mapping Theorem, International Congress of Mathematicians, with John Marafino, August 3, 1994.
- Distributed Computation of Wave Propagation Models Using PVM, Supercomputing '93, with Richard Ewing, Derek Mitchum, Patrick O'leary and Robert Sharpley, November 16, 1993.
- Accurate Local Grid Refinement Schemes for Hyperbolic Flows, Second International Conference on Mathematical and Numerical Aspects of Wave Propagation, with Richard Babarsky, Richard Ewing, Raytcho Lazarov and Robert Sharpley, June 7-10, 1993.
- Time-Centered Advection Schemes for Convection Dominated Flows, SIAM Conference on Mathematical and Computational Issues in the Geosciences, with Richard Babarsky and Robert Sharpley, April 19-21, 1993.
- Nonlinear Interface Conditions in Modeling Elastic Wave Propagation, SIAM Conference on Mathematical and Computational Issues in the Geosciences, with John Spittler and Richard Ewing, April 19-21, 1993.
- Fractal Constructions, Montevideo Middle School, April 6, 1993.

- Numerical Forward and Inverse Solvers for Seismic Wave Propagation, Worcester Polytechnic University, February 19, 1993.
- Numerical Forward and Inverse Solvers for Seismic Wave Propagation, University of Louisville, January 21, 1993.
- Inverse Problems in Seismic Wave Propagation, University of South Carolina, April 1991.
- Numerical Aspects of Seismic Wave Propagation, Virginia Polytechnic Institute and State University, March 22, 1991.
- Vector/parallel implementation of a porous media flow code, with Richard Ewing and Patrick O'Leary, *Supercomputing '91*, Albuquerque, New Mexico November 18–22, 1991.
- Interface Conditions for Acoustic Wave Propagation, with Richard Ewing and Tao Lin, *Proceedings of First International Conference on Mathematical and Numerical Aspects of Wave Propagation Phenomena*, Strasbourg, France, April 23–26, 1991.
- Absorbing Boundary Conditions Using Regions with Exponential Decay, *Proceedings of First International Conference on Mathematical and Numerical Aspects of Wave Propagation Phenomena*, Strasbourg, France, April 23–26, 1991.
- Seismic Modeling and Inversion on the NCUBE, with Patrick O'Leary, Richard Ewing, Robert Sharpley, and Colin Bennett, The Fifth Annual Distributed Memory and Concurrent Computing Conference, Charleston, South Carolina, April 1990.
- Implementing the Picard Method, with Edgar G. Parker, Southeast Atlantic Regional Conference on Differential Equations, October 1990 (refereed).
- Boundary Conditions for Acoustic and Elastic Wave Propagation, Department of Mathematics, University of South Carolina, November 1988.
- Modeling Sound Wave Propagation in the Earth with a Riemann Problem, Modeling and Simulation Conference, University of Pittsburgh, May 1988.

## 9. DIRECTED STUDENT PAPERS

- Timothy J. McDevitt, Two applications of Euler's equations, *Journal of Undergraduate Mathematics*.
- Megan Bickerstaff, Linear Transformations and Three Dimensional Computer Visualization, *Student Thesis*
- Jennifer Cooper, Iterative Methods for Banded Matrices, *Student Thesis*
- John Stein, Finite Difference Codes for Options Modeling, *Student Thesis*
- David Wilk, An Examination of the equation  $y'(t) = f(t, y(t)); y(0) = y_0$ , *Student Thesis*
- James Money, Implementing Picard Iteration for Initial Value Ordinary Differential Equations in a Parallel Environment, *Student Thesis*, Presented at MAA conference, Spring 1998.
- Bernd Hanke, A Comparison of Numerical Methods for Options Pricing, *Student Thesis*

- James Liu, Edgar Parker, James Sochacki and Aren Knutsen (student), Approximation methods for integrodifferential equations, *Proceedings of the International Conference on Dynamical Systems and Applications, III, accepted*, (May 1999).
- James Liu, James Sochacki and Paul Dostert (student), Singular perturbations and approximations for integrodifferential equations, *Proceedings of the International Conference on Control and Differential Equations*, (2000).
- Paul Dostert (student), Numerical approximations of large amplitude suspension bridge oscillations, *Twentieth Annual Southeastern-Atlantic Regional Conference on Differential Equations*, Virginia Tech, (October 2000).
- Nicholas Giffen, Laura Marafino (students), 'Chaos and the Double Pendulum ' UMW Undergraduate Mathematics Conference, January 22, 2005
- Jonathan Graf, Olga Stulov (students), 'What Moves You: Using Legs for Vehicular Transportation', JMU NSF funded REU Program Summer 2009  
<http://www.siam.org/students/siuro/vol5/index.php>.
- Xuyi Guo, Harrisonburg High School, 'Variation in the three-body problem', JMU SUMS Poster Presentation Winner, October, 2010.
- Kristopher Kalish, Yooryeon Jeon , 'Best Student Paper - Mathematics/Physics Section', Virginia Academy of Sciences Annual Meeting, Spring 2010 Meeting. James Madison University.
- Patricia Bellew, ' Best Undergraduate Finance Paper -Solow Growth Analysis: Further Analysis of the Model's Progression Through Time ', Journal of Undergraduate Research in Finance, Georgia State University, 2011 (with Jason Fink).
- John Bridstrop, ' Systems of polynomial ODEs as a tool for improving the efficiency of numerical methods ', Ninth AIMS Conference, Orlando, FL, 2012.
- Philip Parker, 'Solving ODEs using PSM and trees', Ninth AIMS Conference, Orlando, FL, 2012.

## 10. GRANTS AND CONSULTING

- NSF Division: Research Experience for Undergraduates (2013). Using PSM to Study Delay Differential Equations with Chaos. Students: Luke Edwards (Penn State University) and Ben Wiedenaar (Providence).
- NSF Division: Research Experience for Undergraduates (2009). What Moves You: Using Legs for Vehicular Transportation. Students: Jonathan Graf (Towson University) and Olga Stulov (SUNY New Paltz).
- NSF Division: Division of Mathematical Sciences. SCREMS-JMU-2008. with Jason Martin, Roger Thelwell, Charles Pruett.
- NSF, A Collaborative Computational Science Program. James Sochacki, William Ingham, Dorn Peterson and David Pruett, Alade Tokuta (North Carolina Central University), 6/99.
- JMU, Mathematical Software in the Classroom, 6/97.
- NSF, Computational and Visualization Laboratory/Classroom, Richard Babarsky and James Sochacki, PI, 7/93 - Present.
- DOE, Groundwater Modeling at the Savannah River Project, Robert Sharpley of the University of South Carolina, PI, Consultant, 10/91 - 10/92.

- Institute of Scientific Computing of the University of Wyoming, Numerical Modeling, James Sochacki, PI, 9/91-8/92.
- Institute of Scientific Computing of the University of Wyoming, Computer Installation and Maintenance, James Sochacki, PI, 7/91-8/91.
- Enhanced Oil Recovery Institute of the University of Wyoming, Numerical Modeling of Acoustic and Elastic Wave Propagation Occurring in the Earth, James Sochacki, PI, 1/91-6/91.
- NSF, Large Scale Seismic Applications, Richard Ewing of the University of Wyoming, PI, Consultant 1988,1989,1990.

## 11. TEXTBOOKS

- with Peterson, Gary; Linear Algebra and Differential Equations, Pearson, 2001.
- with Buetow, Gerald; Term-Structure Models Using Binomial Trees, The Research Foundation of AIMR, 2001.