James K. Sprague

PhD, PE

Principal, Director of Automotive Biomechanics & Design

Dr. James K. Sprague specializes in dynamics and kinematics of rigid body systems, including modeling, numerical simulation and analysis, vehicle dynamics and tire mechanics, statistical data analysis, accident reconstruction, testing and analysis of vehicles, automotive systems and components, ergonomics of vehicle interiors and entryways, dynamics of gears and power trains, and safety requirements for machine tools. He also handles instrumentation, design of experiments and analysis of data, biomechanics of human movement, locomotion, mobility and balance, and gerontological biomechanics and sports biomechanics.

Dr. Sprague is active in many technical and professional societies and has published many articles in referred journals and conference proceedings.

Education

PhD, Mechanical Engineering, University of Michigan, Ann Arbor, MI, 1994

MS, Mechanical Engineering, University of Akron, Akron, OH, 1989

BS, Mechanical Engineering, University of Illinois at Urbana, Champaign, IL, 1984

Licenses & Certifications

- Michigan PE License 6201041636
- Illinois PE License 062-057700
- Ohio PE License 68998

Positions Held

Engineering Systems Inc., Ann Arbor, Michigan

- Director of Automotive Biomechanics and Design, 2017 - Present

Contact Information

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ESi

1174 Oak Valley Dr.
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Areas of Specialization

- Automotive and Industrial Accident Reconstruction
- Biomechanics of Human Movement
- Conspicuity, Night - Time Visibility
- Failure Analysis of Mechanical Components
- Failure Analysis of Tires and Tire Mechanics
- Limit Behavior of Road Vehicles
- Intellectual Property
- Risk Assessment, Quality Management

- Principal, 2010 – Present
- Manager of Michigan Operations, 2010 - 2017

Packer Engineering, Inc., Ann Arbor, Michigan

- Senior Vice President, 2008 - 2010
- Vice President, 2003 - 2008

Exponent, Failure Analysis Associates, Farmington Hills, Michigan

- Managing Engineer, 1995 - 2002

University of Michigan Transportation Research Institute, Ann Arbor, Michigan

- Post - Doctoral Researcher, 1994 - 1995

University of Michigan College of Engineering, Ann Arbor, Michigan

- Research Assistant (Biomechanics), 1991 - 1994
- Teaching Assistant, Lecturer - ME240 (Dynamics), 1989 - 1991

Mechanical Dynamics, Inc., Ann Arbor, Michigan

- Consultant and Sponsored Researcher, 1989 - 1991

The Goodyear Tire and Rubber Corporation, Akron, Ohio

- Vehicle Dynamics Modeling and Analysis, 1987 - 1989
- Racing Tire Design and Development, 1984 - 1987

Continuing Education

- **Passenger Restraint Safety Systems -** Institute of Police Technology and Management, University of North Florida, 2025
- **Assessing Suitability for Robotics in Manufacturing: A Case Study -** Certificate of Completion, The American Society of Mechanical Engineers, 2025
- **Problem-Solving for Engineers: Root Cause Analysis Fundamentals -** Certificate of Completion, The American Society of Mechanical Engineers, 2025

- **Ethical Case Insights Part I: Disclosing, Standing Your Ground, and Dealing with Conflicts -** National Society of Professional Engineers, 2025
- **Doing Bad Things for Good Reasons: An Examination of Unethical Pro-Organizational Behavior Among Professional Workers -** National Society of Professional Engineers, 2025
- **Event Data Recorder Update and Analysis -** Ruth Consulting, Atlanta, GA, 2023
- **National Society of Professional Engineers -** Continuing Education Seminars, NSPE, 2023
- **Accident Reconstruction, The Autonomous Vehicle and ADAS -** Certificate of Achievement, SAE International, 2022
- **Applying Automotive EDR Data to Traffic Crash Reconstruction -** Certificate of Achievement, SAE International, 2021
- **Traffic Signal Timing Records Interpretation and Analysis -** Traffic Signal Academy, University of Tennessee, 2020
- **HVE Forum -** Certificate of Completion, Engineering Dynamics Corporation, Austin, TX, 2020
- **Applied Vehicle Dynamics Course -** Autobahn Country Club, Joliet, IL, 2018
- **Human Factors in Traffic Crash Reconstruction -** Institute of Police Technology Management, University of North Florida, Fort Myers, FL, 2017
- **Traffic Crash Reconstruction I -** Northwestern University Center for Public Safety, Ann Arbor, MI, 2015
- **Vehicular Crash Reconstruction Methods Seminar -** Certificate of Achievement, SAE International, Troy, MI, 2014
- **Crash Data Retrieval (CDR) Technician Level 1 -** Collision Safety Institute, Ft. Myers, 2014
- **Leading High-Performing Teams -** University of Michigan, 2013
- **Metallurgy for the Non-Metallurgist -** ASM International, 2006
- **Industrial Fork Truck Operator Safety Training -** 2006
- **Mine Safety and Health Administration Hazard Certification for Coal and Underground -** 2006
- **HVE Simulator -** Engineering Dynamics Corporation, 2005
- **OSHA 10-Hour General Industry Safety Standards -** 2004

- **Crash Data Retrieval -** Michigan State University Highway Traffic Safety Program, 2003
- **Mechanics of Heavy-Duty Trucks and Truck Combinations -** University of Michigan, 1998
- **Photogrammetry in Accident Reconstruction -** SAE, 1998
- **Traffic Accident Reconstruction I -** The Traffic Institute, Northwestern University, 1996
- **Bertil Roos Racing School Competitive Driving Class -** Akron, OH, 1988
- **ADAMS (Automatic Dynamic Analysis of Mechanical Systems) Training -** MDI Ann Arbor, MI 1986
- **Tire Mechanics -** University of Akron, 1985
- **Vehicle Dynamics -** Milliken Research Associates, Buffalo, NY, 1985

Professional Affiliations/Honors

American Society of Mechanical Engineers (ASME)

- Member

Society of Automotive Engineers (SAE)

- Member

National Society of Professional Engineers (NSPE)

- Member

Journal of Failure Analysis and Prevention

- Reviewer, 2014 - 2020

Journal of Biomechanics

- Reviewer 1995 - 1997

Standards Development – ANSI B11

Committee Member, B11.9 Safety Requirements for Grinding Machines, 2007 – 2012

Project Experience

Investigations

Quality Management System Assessment - Manufacturing Sector

- Performed extensive interviews, research and plant visits to document client's historical and current state.
- Performed analysis of client's internal risk assessment and FMEA effectiveness.
- Presented recommendations for corporate prioritization.

Intellectual Property - $1.2B Trade Secret Dispute

- 3 year project involving analysis of 27 alleged trade secrets regarding an innovative tire technology concept.
- Rebuttal response to 443 page plaintiff's expert report arguing that all trade secrets were "generally known or readily ascertainable."
- Deposition, development of exhibits (both physical models and extensive animation) and eventual trial.

Low-Illumination Conspicuity - Helicopter Crash

- Performed specialized still and video photography to create an accurate representation of visual cues experienced by helicopter pilots through various stages of twilight.
- Performed two flight inspections on government aircraft. Extensive collaboration with ESi aviation colleagues.

Line-of-Sight Analysis - Vehicle vs. Pedestrian

- Performed full analysis of driver's field of regard, including blockages due to vehicle components and structure.
- Performed human kinematics study utilizing laser scanning for static positions, and full motion capture for dynamic aspects of both drivers and pedestrians.
- Created physics and motion capture based animation exhibits depicting ESi's accident reconstruction. Exhibits conveyed view and conspicuity from perspective of all parties, as well as first availability of warning stimulus to driver.
- This approach has been successfully utilized in cars, heavy trucks, municipal busses and delivery vehicles.

Tire Failure Analysis - Various

- Ranging from toy wagon tires up through large aircraft and mining truck tires.
- Assessment of alleged failure modes including manufacturing, maintenance, road hazard, etc…
- Tire analysis is often usefully integrated and/or provides insight into larger questions pertaining to overall vehicle behavior during crashes or other incidents of interest.

Publications

"Final Report: Phase IV Compliance Testing for Locomotive LED Headlights and Auxiliary Lights" M. Meza-Arroyo, **J.K. Sprague**, P.A. Shibata, S. Woods. U.S. Department of Transportation, Federal Railroad Administration, Washington, DC. July 2020.

"Comparative Lumbar Spine Acceleration Data During Daily and Dynamic Activities, Tasks of Daily Driving, and Low Speed Lateral Vehicle Impacts" P.A. Shibata, A.E. Mathias, A.E. Light, M. Meza-Arroyo, **J.K. Sprague**, A.L. Stern. Biomedical Sciences Instrumentation, 56th Annual Rocky Mountain Bioengineering Symposium, Milwaukee, WI. Biomedical Sciences Instrumentation Journal, Volume 55(2). pp. 159-166, April 2019.

"Head Acceleration Measurements During Vehicle Driving Tasks and Lateral Impacts Relative to Head Accelerations During Daily and Dynamic Activities" P.A. Shibata, A.E. Mathias, A. Light, M. Meza-Arroyo, **J.K. Sprague**, A.L. Stern. Biomedical Sciences Instrumentation, 56th Annual Rocky Mountain Bioengineering Symposium, Milwaukee, WI. Biomedical Sciences Instrumentation Journal, Volume 55(2). pp. 120-127, April 2019.

"Enhancing Contrast - Sensitivity Charts for Validating Visual Representations of Low Illumination Scenes" J.K. Sprague, M. Meza-Arroyo, P.A. Shibata, J.A. Auflick. SAE Technical Paper 2019-01-1009, 2019.

"The Kinematic Analysis of Occupant Excursions and Accelerations During Staged Low Speed Far-Side Lateral Vehicle-to-Vehicle Impacts" P.A. Shibata, J.M. Roberts, **J.K. Sprague**, A.E. Light, J.A. Stegemann, M. Meza-Arroyo, S.P. Capser. SAE Technical paper 2019-01-1030, 2019.

"Human Factors Techniques in the Analysis of Low Illumination Accidents: Integrating Conspicuity, Validated Photography, and Scientific Animation" J.L. Auflick, **J.K. Sprague**, P.A. Shibata, D.H. Kruger. Proceedings of the Human Factors and Ergonomics Society 59th Annual Meeting, Los Angeles, CA, October 26 - 29, 2015.

"Overload Fracture of Cast Aluminum Wheel" Journal of Failure Analysis and Prevention, E.R. Weishaupt, M.E. Stevenson, **J.K. Sprague**. Volume 14, Issue 6, December 2014.

"A Link Between Occupant and Vehicle Accelerations During Common Driving Tasks" Biomed Sci Instrum, A.C. Mathias, P.A. Shibata, and **J.K. Sprague**. Presented at the 51st Annual Rocky Mountain Bioengineering Symposium, Denver, CO, 50:197-204 (2014).

"Analysis of Nighttime Vehicular Collisions and the Application of Human Factors: An Integrated Approach" J.K. Sprague, P.A. Shibata, and J.L. Auflick. SAE Technical Paper 2014-01-0442, SAE International, 2014.

"Determining Angular Head Accelerations Using an External Array of Linear Accelerometers: A Preliminary Analysis of Everyday Activities" L.A. Wojcik, P.A. Shibata, and **J.K. Sprague**. Proceedings of the 2005 Summer Bioengineering Conference, J.S. Wayne, F. Guilak, G.A. Livesay, and J.W. Holmes, eds., The American Society of Mechanical Engineers, #b0055211, Vail, CO, 2005.

"Automated Stability Analysis of a Vehicle in Combined Pitch and Roll" Advanced Vehicle Simulation and Virtual Proving Ground, International Mechanical Engineering Congress and Exposition. Paper IMECE2002-33184, 2002.

"Proper Model Generation: An Energy-Based Methodology" L.S. Louca, J.L. Stein, G.M. Hulbert, and **J.K. Sprague**. Proceedings of the 1997 International Conference on Bond Graph Modeling and Simulation, Phoenix, AZ, 1997.

"The Use of Stepping to Maintain Upright Balance: Biomechanical Analyses in Young and Old Adults" J.K. Sprague, Ph.D. Thesis, University of Michigan, Ann Arbor, MI, 1994.

"The Safety and Mobility of Older Drivers: What We Know and Promising Research Issues" The University of Michigan Transportation Research Institute Final Report to American Automobile Manufacturers Association, Ann Arbor, MI, 1994.

"ADAMS/A Tire User's Manual Version 6.0.0." Analytical Tire Modeling Software for use with ADAMS, 1990.

"Dynamic Tooth Loading in a Compliant Gear Mesh with Rim Effects" J.K. Sprague, Master's Thesis, University of Akron, Akron, OH, 1989.

"Human Factors Techniques in the Analysis of Low Illumination Accidents: Integrating Conspicuity, Validated Photography, and Scientific Animation" J.L. Auflick, **J.K. Sprague**, P.A. Shibata, and, D.

Kruger, Proceedings of the Human Factors and Ergonomics Society 59th Annual Meeting, Los Angeles, CA, October 26–29, 2015.

"Human Factors Techniques in the Analysis of Low Illumination Accidents: Integrating Conspicuity, Validated Photography, and Scientific Animation" J.L. Auflick, **J.K. Sprague**, P.A. Shibata, and, D. Kruger, Proceedings of the Human Factors and Ergonomics Society 59th Annual Meeting, Los Angeles, CA, October 26–29, 2015.

Presentations

"Human Factors: Answering the How and Why Questions" J.K. Sprague and J.L. Auflick. In House Continuing Education Technical Presentation for State Farm Attorneys, Withrow & Associates, Toronto, ON, Canada, September 5, 2012.

"Automotive Failure Analysis: How They Crash, How They Break" Continuing Education Technical Presentation for attorneys and insurance professionals, ESI - Ann Arbor, Michigan Open House Event, Co-Lecturer with G.R. Rogers, P.E., May 17, 2012.

"Accident Reconstruction & Injury Analysis" Guest Lecturer, Chartis Insurance Company, Atlanta, GA, April 12, 2012.

"Risk Assessment Methods" Presenter, Annual Product Safety & Liability Conference, Milwaukee, WI, 2009.

"Risk Management Forum" Presenter, Midwest Truckers Association, Collinsville, IN, 2008.

"CIV ENG 395-0 Engineering Forensics" Invited Guest Lecturer at Northwestern University, Robert R. McCormick School of Engineering and Applied Science, Chicago, IL, 2006.

"Biomechanics of Stepping Balance" Seminar, The Cleveland Clinic, Cleveland, OH, 1994.

"Do Young and Old Adults Differ in Their Use of Steps to Recover Upright Balance" Presentation, The Gerontological Society of America Program Committee Annual Meeting, 1994.

"A Biomechanical Analysis of the Use of Stepping to Maintain Balance" Presentation, American Society of Mechanical Engineers Summer Bioengineering Conference, 1993.