

Professional Resume

Dr. Steven Kirkpatrick

Senior Engineer

Specialization

Crashworthiness and transportation safety; nonlinear finite element analysis; blast, impact, and penetration mechanics; biomechanics, structural dynamics; dynamic buckling; mechanics of composite materials; occupant kinematics and injury assessment; applied mechanics.

Education

Ph.D. in Mechanical Engineering, Stanford University (1999)

M.S. in Mechanical Engineering (1984), University of California (Berkeley);

B.S. (with honors) in Applied Mechanics (1983), University of California (San Diego);

Experience

Currently Senior Engineer, Applied Research Associates, Inc.

1985-1999 Research Engineer, SRI International

Research Assignments

2003-2009 Director – U.S. Department of Transportation Federal Highway Administration sponsored Center of Excellence in Finite Element Crash Analysis. Analysis and development of traffic barriers, design and evaluation of roadside hardware, analysis of vehicle response and motions from impacts with roadside structures.

2007-2008 Principal Investigator – Development of the next generation railroad tank car project. Part of a cooperative program with participation of the railroads, tank car builders, and hazardous chemical producers/shippers to develop a new rail tank car design that is significantly more robust in collisions, derailments, and other extreme loading environments.

2003-2008 Principal Investigator – National Institute of Standards and Technology (NIST) sponsored investigation into the dynamic response and damage produced by the aircraft impacts into the World Trade Center Towers. Principal Investigator of the NIST investigation of the progressive collapse of the World Trade Center 7 Tower.

2004-2006 Development of a Simulation Based Design (SBD) system for military vehicles subjected to mine and blast threats.

- 1996-2005 Analysis of impact mechanics of penetrators and reinforced concrete structures. Analysis of high-speed penetration mechanics.
- 2002-2003 Blast response of concrete and masonry structures. Injury assessment for personnel subjected to blast and impact loading.
- 1999-2005 Evaluation of rail vehicle crashworthiness, development of a commuter rail seat design incorporating lap and shoulder belts, development of a model for predicting rail vehicle collision responses including crush and vehicle gross motions.
- 1994-1999 Hazard risk assessment for damaged pressure tank cars involved in derailments or collisions. Detailed finite element analysis of laboratory tests on tank car steels and development of fracture criteria. Analysis of collision loads and impact deformations of stub sill tank cars.
- 1989-2008 Developed and applied simulation techniques for failure analysis of materials and structures. Developed crack propagation algorithms for the DYNA3D finite element code with a local damage model for predicting dynamic failure of steel weldments. Incorporation a variety of new material and damage models into large-scale finite element structural analysis codes including polymer and metal matrix composite damage models, brittle fracture models, and ductile damage models for metals.
- 1993-1999 Nonlinear dynamic finite element analysis of train crashworthiness, including collision response of high-speed passenger trains, hazard risk from derailment of high-speed passenger trains.
- 1996-1999 Development of a high-fidelity finite element model of the Ford Crown Victoria for crashworthiness studies.
- 1993-1998 Analysis and modeling of anthropomorphic dummies used in crash testing of automobiles. Developed DYNA3D model of the Side Impact Dummy (SID) for evaluation of dummy performance and analysis of material and geometric parameters on dummy responses.
- 1985-1998 Performed experiments and finite element analyses to evaluate dynamic structural response of various aerospace structures to impulsive and impact loadings.

Honors and Recognitions

Applied Research Associates Fellow (2009)

Wyman-Gordon Foundation Research Grant (1984)

Affiliations (Current and Past)

Member American Society of Mechanical Engineering (ASME)

Member of the American Society Mechanical Engineers (ASME) Rail Transit Vehicle Standards Committee RT-1, Safety Standards for Light Rail Transit Vehicles.

Member of the ASME Rail Transit Vehicle Safety Standards Subcommittee on Vehicle Compatibility.

Member Society for Automotive Engineering

Member American Institute for Aeronautics and Astronautics

Member Society for Advanced Materials and Process Engineering

Selected Publications

Journal and Proceeding Publications

1. S.W. Kirkpatrick, R.T. Bocchieri, C. Navarro-Northrup, R.A. MacNeill, and B.D. Peterson, "Modifications to Light Rail Vehicles for Improved Compatibility in Collisions with Automobiles," Proceedings of the APTA/TRB 2009 Joint Light Rail Conference, Los Angeles, CA, April 21, 2009.
2. P.E. Strong and S.W. Kirkpatrick, "Development and Application of Structural Design Standards for Safety of Light Rail Cars and Streetcars," Submitted for APTA/TRB 2009 Joint Light Rail Conference, Los Angeles, CA, April 21, 2009.
3. S.W. Kirkpatrick, R.A. MacNeill, J. Smith, K. Herrle, and M. Ereksion, "Methodologies for Progressive Collapse Analysis," Presented at the ASCE 2009 Structures Congress, organized by the Structural Engineering Institute of ASCE, April 29 - May 2, 2009.
4. R T Bocchieri, S W Kirkpatrick, and B.D. Peterson, "Simulation-Based Design of Vehicles Exposed to Blast Threats for Improved Occupant Survivability," Submitted to the Third International Conference on Safety and Security Engineering, Rome, Italy, July 1-3 2009.
5. Schroeder, M.P., Kirkpatrick, S.W. and Strong, P.E., "A Crash Energy Management Design Approach for Light Rail Vehicles," Proceedings of the 2007 American Public Transportation Association Rail Conference, Toronto, ON, June 3-6, 2007.
6. Kirkpatrick, S.W., MacNeill, R.A., Gough, G. and Hice, E., "Development of Crash Energy Management for Light Rail Vehicles," Proceedings of JRCICE2007, ASME/IEEE Joint Rail Conference & Internal Combustion Engine Spring Technical Conference, Pueblo, Colorado, USA, Paper Number JRCICE2007-40114, March 13-16, 2007.
7. Peterson B.D., S.W. Kirkpatrick, R.T. Bocchieri, "Advances in Finite Element Simulation of Blast Response to Structures", 48th AIAA/ASME/ASCE/AHS/ASC Structures, Dynamics, and Materials Conference, Honolulu, HI, 2007.
8. S.W. Kirkpatrick, B.D. Peterson, and R.A. MacNeill, "Finite Element Analysis of Train Derailments," ICrash2006. Proceedings of the International Crashworthiness Conference, July 4-7, 2006, Athens, Greece.
9. R T Bocchieri and S W Kirkpatrick, "Evaluation of Bridge Rail Designs using Probabilistic Finite Element Crash Simulations," ICrash2006. Proceedings of the International Crashworthiness Conference, July 4-7, 2006, Athens, Greece.
10. R T Bocchieri, S W Kirkpatrick, and Fahim Sadek, "Development of an Aircraft Model for Impact Analysis," ICrash2006. Proceedings of the International Crashworthiness Conference, July 4-7, 2006, Athens, Greece.
11. S.W. Kirkpatrick, R.T. Bocchieri, R.A. MacNeill, B.D. Peterson, and F. Sadek, "Modeling Methodologies for Assessment of Aircraft Impact Damage to the World Trade Center Towers," Proceedings of the 9th International LS-DYNA Users Conference, pp. 9-53 through 9-67, Dearborn MI, USA, June 4-6, 2006.
12. S.W. Kirkpatrick and M.P. Schroeder, "Crashworthiness Standards for the U.S. Light Rail Environment," TRB Tenth National Light Rail Transit Conference, St. Louis, Missouri, April 9-11, 2006.

13. Bocchieri, R.T, B. D. Peterson, S. W. Kirkpatrick, R.C. Goetz, "IED Fragment/Airblast Threat Module for the Simulation-Based Design System," Presented at the Ground Vehicle Survivability Symposium (GVSS), Redondo Beach, CA, March 28-30, 2006.
14. S.W. Kirkpatrick, B.D. Peterson, R.C. Goetz, and R.A. MacNeill, "Simulation-Based Design for Vehicles Exposed to Blast and Fragment Threats," Presented at the Ground Vehicle Survivability Symposium (GVSS), Redondo Beach, CA, March 28-30, 2006.
15. S.W. Kirkpatrick, R.T. Bocchieri, R.A. MacNeill and F. Sadek, "Preliminary Analyses of Aircraft Impact into the WTC Towers," To be presented at the 2005 International Conference on Structural Safety and Reliability (ICOSSAR).
16. Peterson B.D., Goetz, R., Kirkpatrick, S.W., and Holmes, B.S., "Simulation-Based Design for Vehicles Exposed to Mine Threats," Proceedings of the 2005 Ground Vehicle Survivability Symposium (GVSS), Monterey, CA, April 12-14, 2005.
17. S.W. Kirkpatrick and R.W. Klopp, "Risk Assessment for Damaged Pressure Tank Cars," 2003 *COMPUTER TECHNOLOGY AND APPLICATIONS*, ASME Publications, Proceedings of: PVP2003 - The 2003 ASME PVP Conference, July 20-24, 2003, Cleveland, Ohio, W. Reinhardt and D.J. Martin, Eds.
18. S.W. Kirkpatrick, R.A. MacNeill, and R.T. Bocchieri, "Development of an LS-DYNA Occupant Model for use in Crash Analyses of Roadside Safety Features," Transportation Review Board, Paper No. TRB2003-0002450, Proc. of the 2003 TRB 82nd annual meeting, Washington D.C., Jan. 12-16, 2003.
19. S.W. Kirkpatrick, M.P. Schroeder, and J.C. Valdés Salazar, "Developing Guidelines for Crashworthiness of Light Rail Vehicles in Mixed Fleet Operations," Proceedings of IMECE-02: 2002 ASME International Mechanical Engineering Congress and Exposition, Paper No. IMECE2002-34623, New Orleans, Louisiana, November 17-22, 2002
20. S.W. Kirkpatrick and R.A. MacNeill, "Development of a Computer Model for Prediction of Collision Response of a Railroad Passenger Car," Proceedings of: JRC2002, The 2002 ASME/IEEE Joint Rail Conference, April 23-25, 2002, Washington D.C.
21. R.A. MacNeill and S.W. Kirkpatrick, "Post-Collision Inspection and Data Analysis of a Passenger Rail Car," Proceedings of: JRC2002, The 2002 ASME/IEEE Joint Rail Conference, April 23-25, 2002, Washington D.C.
22. S.W. Kirkpatrick, M. Schroeder, and J.W. Simons, "Evaluation of Passenger Rail Vehicle Crashworthiness," International Journal of Crashworthiness, IJCrash Vol. 6 No. 1 pp. 95-106, 2001.
23. S.W. Kirkpatrick, M. Schroeder, and J.W. Simons, "Evaluation of Passenger Rail Vehicle Crashworthiness," ICrash 2000. Proceedings of the International Crashworthiness Conference, September 6-8, 2000, London, UK, E. C. Chirwa and D. Otte Eds., pp. 58-68.
24. S.W. Kirkpatrick and R.W. Klopp, "Hazard Assessment for Pressure Tank Cars Involved in Accidents," ICrash 2000. Proceedings of the International Crashworthiness Conference, September 6-8, 2000, London, UK, E. C. Chirwa and D. Otte Eds., pp. 223-235.
25. S.W. Kirkpatrick, J.W. Simons, and T.H. Antoun, "Development and Validation of High Fidelity Vehicle Crash Simulation Models," International Journal of Crashworthiness, IJCrash Vol. 4, No. 4, pp. 395-405, 1999.
26. M. H. Ray, K. Hiranmayee, and S.W. Kirkpatrick, "Performance Validation of Two Finite Element Models of a Side Impact Dummy," International Journal of Crashworthiness, IJCrash Vol. 4, No. 3, pp. 287-303, 1999.
27. S.W. Kirkpatrick, "Development and Validation of High Fidelity Vehicle Crash Simulation Models," Computer Applications for Crash, Optimization, and Simulation Research, SAE Publications SP-1496,

- Proceedings of the 2000 International Congress and Exposition, March 6-9, 2000, SAE Paper No. 2000-01-0627.
28. J.W. Simons, S.W. Kirkpatrick, R.W. Klopp, and L. Seaman, "Methods for Modeling Damage in Finite Element Calculations," IA'99, Proceedings of International Seminar on Quasi-Impulsive Analysis, Nov. 15-16, 1999, Osaka, Japan.
 29. J.W. Simons and S.W. Kirkpatrick, "High-Speed Passenger Train Crashworthiness and Occupant Survivability," International Journal of Crashworthiness, IJCrash Vol. 4, No. 2, pp. 121-132, 1999.
 30. J.H. Giovanola, S.W. Kirkpatrick, and J.E. Crocker, "Fracture of Geometrically Scaled Notched Three-Point-Bend Bars of High Strength Steel," Journal of Engineering Fracture Mechanics, Vol 62, No. 2-3, pp. 291-310, March, 1999.
 31. S.W. Kirkpatrick, J.W. Simons, and T.H. Antoun, "Development and Validation of High Fidelity Vehicle Crash Simulation Models," Int. J. Crashworthiness, IJCrash98 International Crashworthiness Conference, pp. 602-611, 1998.
 32. J.W. Simons and S.W. Kirkpatrick, "High-Speed Passenger Train Crashworthiness and Occupant Survivability," Int. J. Crashworthiness, IJCrash98 International Crashworthiness Conference, pp. 216-226, 1998.
 33. M. H. Ray, K. Hiranmayee, and S.W. Kirkpatrick, "Performance Validation of Two Side Impact Dummies," Int. J. Crashworthiness, IJCrash98 International Crashworthiness Conference, pp. 285-298, 1998.
 34. J.H. Giovanola and S.W. Kirkpatrick, "Using the Local Approach to Investigate Scaling Effects in Ductile Fracture," International Journal of Fracture, Vol. 92, No. 2, pp. 101-117, 1998.
 35. J.H. Giovanola, R.W. Klopp, and S.W. Kirkpatrick, "A Note on One-Point-Bend Impact Fracture Experiments with Curved Specimens," Technical Note, Journal of Testing and Evaluation, JTEVA, ASTM Publications, Jan. 1998, pp. 79-81.
 36. J.H. Giovanola, S.W. Kirkpatrick, and J.E. Crocker, "Investigation of Scaling Effects in Elastic-Plastic Ductile Fracture Using the Local Approach," Proceedings of the First European Mechanics of Materials Conference on Local Approach to Fracture, Euromech-Mechamat '96, Fontainebleau-France, Sept. 9-11, 1996.
 37. S.W. Kirkpatrick, J.H. Giovanola, and J.W. Simons, "DYNA3D Analysis of Dynamic Fracture of Weldments," IA'96, Proceedings of International Seminar on Quasi-Impulsive Analysis, Nov. 20-22, 1996, Osaka, Japan, pp. A6.1-15, K. Wakiyama, E. Tachibana, K. Imai and T. Kitano Eds.
 38. J.H. Giovanola, S.W. Kirkpatrick, and J.E. Crocker, "Investigation of Scaling Effects in Elastic-Plastic Ductile Fracture Using the Local Approach," JOURNAL DE PHYSIQUE IV, Colloque C6, supplement au Journal de Physique III, Volume 6, pp. C6-513-520, Octobre 1996.
 39. J.H. Giovanola, S.W. Kirkpatrick, and J.E. Crocker, "Experimental and Computational Investigation of Scaling Effects in Elastic-Plastic Ductile Fracture," *Dynamic Plasticity and Structural Behaviors*, Supplement Volume, Proc. of Plasticity '95: The Fifth International Symposium on Plasticity and its Current Applications, pp. 30-33, 1995.
 40. S.W. Kirkpatrick, B.S. Holmes, T.C. Hollowell, C. Gabler, and T. Trella, "Finite Element Modeling of the Side Impact Dummy (SID)," *Human Surrogates: Design, Development, & Side Impact Protection*, SAE Publications, SP-945, pp. 75-86, Presented at the 1993 International Congress and Exposition, March, 1993, SAE Paper No. 930104.
 41. J.H. Giovanola and S.W. Kirkpatrick, "Methodology for Evaluating Strength and Fracture Resistance of Weldments Using a Local Approach to Fracture," *Pressure Vessel Integrity - 1993*, ASME Publications, PVP-20, pp. 157-171, 1993

42. B.S. Holmes, S.W. Kirkpatrick, J.W. Simons, J.H. Giovanola, and L. Seaman, "Modeling the Process of Failure in Structures," *Structural Crashworthiness and Failure*, T. Wierzbicki and N. Jones Eds., Elsevier Publishing Co., 1993.
43. J.H. Giovanola and S. W. Kirkpatrick, "Applying a Simple Ductile Fracture Model to Fracture of Welded T-Joints," *Advances in Local Damage/Fracture Models for the Analysis of Engineering Problems*, ASME Pubs., ASME-AMD Vol. 137, 1992.
44. T.H. Antoun, P.R. Gefken, B.S. Holmes, and S.W. Kirkpatrick, "Description of a Six-Inch Gas Gun Facility for Soft Body Impact," Proceedings 43rd Annual Meeting of the Aeroballistic Range Association (ARA), Paper No. 50, Sept. 28 to Oct. 2, 1992.
45. Kirkpatrick, S.W. and Holmes, B.S., "Static and Dynamic Buckling of Thin Cylindrical Shells," *Computational Aspects of Impact and Penetration*, R.F. Kulak and L.E. Schwer Eds., Elmepress International, Annandale VA, 1991.
46. Giovanola, J.H., Klopp, R.W. Kirkpatrick, S.W. and McDonald, W.W., "Dynamic Fracture of Welded Joints," *J. de Physique, Colloque C3, Suppl. III, Vol. 1*, pp. 565-572, 1991.
47. Giovanola, J.H., Klopp, R.W. Kirkpatrick, S.W. and McDonald, W.W., "Dynamic Fracture of Welded Joints," Proceedings DYMAT 91 Conference, Strasbourg, Oct. 1991.
48. Kirkpatrick, S.W., Curran, D.R., Erlich, D.C., and Klopp, R.W., "Three-Dimensional Analyses of Plate Impact Experiments with Circular and Star Geometries," *Shock Waves in Condensed Matter*, Proceedings of the APS 91 topical conference, Williamsburg VA, S.C. Schmidt et al. Eds., Elsevier Science Pubs., June 1991.
49. Florence, A.L., Gefken, P.R., and Kirkpatrick, S.W., "Dynamic Plastic Buckling of Copper Cylindrical Shells," *Int. J. Solids and Structures*, Vol. 27, No. 1, pp.89-103, 1991.
50. Holmes, B.S., Kirkpatrick, S.W. and LeMonds, J., "Ductile Failure of Shells Following Multiaxial Dynamic Strain Histories," ASME Publications, ASME Winter Annual Meeting, 1990.
51. Kobayashi, T. Giovanola, J.H., Kirkpatrick, S.W., Simons, J.W. and Holmes, B.S., "Reconstruction of Fracture Processes in Thin Aluminum Sheet Using Fracture Surface Topography Analysis (FRASTA)," 1990.
52. Kirkpatrick, S.W. and Holmes, B.S., "Collapse of Thin Cylindrical Shells Under Combined Static Axial and Dynamic Radial Loads," *Recent Advances in Impact Dynamics of Engineering Structures - 1989*, ASME Pubs., AMD-Vol. 105, AD-Vol. 17, 1989.
53. Kirkpatrick, S.W. and Holmes, B.S., "Axial Buckling of a Thin Cylindrical Shell: Experiments and Calculations," *Computational Experiments*, ASME Publications, PVP Vol. 176, pp. 67-74, 1989.
54. Kirkpatrick, S.W. and Holmes, B.S., "The Effect of Initial Imperfections on Dynamic Buckling of Shells," *ASCE J. Engng. Mech.*, Vol. 115, No. 5, pp. 1075-1093, May 1989.
55. Gefken, P.R., Kirkpatrick, S.W., and Holmes, B.S., "Response of Impulsively Loaded Cylindrical Shells," *Int. J. Impact Engng.*, Vol. 7, No. 2, pp. 213-227, 1988.
56. Schwer, L.E., Holmes, B.S., and Kirkpatrick, S.W., "Response and Failure of Metal Tanks to Impulsive Spot Loading: Experiments and Calculations," *Int. J. Solids and Structures*, Vol. 24, No. 8, pp. 817-833, 1988.
57. Holmes, B.S., Kirkpatrick, S.W., and Schwer, L.E., "Response of Metal Tanks to Impulsive Spot Loading: Experiments and Calculations," *Impact: Effects of Fast Transient Loadings*, pp. 317-332, Ammann et al. (eds), A.A. Balkema Pubs., Rotterdam, 1988.
58. Kirkpatrick, S.W. and Holmes, B.S., "Structural Response of Thin Cylindrical Shells Subjected to Impulsive External Loads," *AIAA J.*, Vol. 26, No. 1, pp. 96-103, January 1988.

59. Prantil, V.C., Kirkpatrick, S., Holmes, B.S., and Hallquist, J.O., "Response of a Very Thin Shell under an Impulsive Radial Load," *Finite Element Methods for Plate and Shell Structures 2: Formulations and Algorithms*, T.J.R. Hughes and E. Hinton (Eds), Pineridge Press LTD. Swansea, U.K., 1986.

Technical Reports

1. S.W. Kirkpatrick, "Detailed Puncture Analyses of Various Tank Car Designs," ARA Final Technical Report, Prepared for the Next Generation Railroad Tank Car (NGRTC) Project, January, 2009.
2. S.W. Kirkpatrick, "Development of Crash Energy Management Performance Requirements for Light-Rail Vehicles," ARA Final Technical Report, TCRP Web-Only Document 40, Final Report for TCRP Project C-17, April, 2008.
3. S.W. Kirkpatrick and R.T. Bocchieri, "Force Protection Structural Damage Assessments," ARA Final Technical Report, ARA Project Number 5707, July, 2007.
4. R. Walker and S.W. Kirkpatrick, "Indian Railways Crashworthiness Project," TTCI Technical Report P-07-003, Prepared for Rites, Ltd., January, 2007.
5. R. T. Bocchieri and S. W. Kirkpatrick, "A Review Of Computational Models For Human Injury - With Emphasis on the Head, Brain, Neck, Spine and Thorax," ARA Technical Report, ARA Project No. 17915, Jan, 2007.
6. T.L. Anderson and S.W. Kirkpatrick, "Quantifying and Enhancing Puncture Resistance in Railroad Tank Cars Carrying Hazardous Materials," Technical Report, Prepared for The Chlorine Institute, August 7, 2006.
7. S.W. Kirkpatrick and R.T. Bocchieri, "Evaluation of Aesthetic Bridge Rails for California Highways," Final Technical Report, Center of Excellence in Finite Element Crash Analysis, July 25, 2006.
8. S.W. Kirkpatrick, "Fracture Fixation System Design - Intact Tibia Baseline Performance," Technical Report, May 17, 2006.
9. S.W. Kirkpatrick, "Pretest Predictions for the Platen Car Impact Tests 2 and 3," Technical Report, February 8, 2006.
10. Kirkpatrick, S.W., and Bocchieri, R.T., "Bridge Sheath Fracture Analyses," ARA Technical Report, November 22, 2005.
11. Kirkpatrick, S.W., Bocchieri, R.T., Sadek, F., Robert A. MacNeill, R.A., Holmes, B.S., Peterson, B.D., Cilke, R.W., and Navarro, C., "Analysis of Aircraft Impacts into the World Trade Center Towers," NIST NCSTAR 1-2B, National Institute of Standards and Technology (NIST) Investigation, October, 2005.
12. S.W. Kirkpatrick, "Development of a Modified Crashworthy SLR Car for Indian Railway," SLR Design Report, September 2, 2005.
13. Kirkpatrick, S.W. and Peterson, B.D., "Simulation Based Design for Vehicles Exposed to Mine Threats," ARA Technical Report, June 30, 2005.
14. Kirkpatrick, S.W., and R. A. MacNeill, "Charlotte Light Rail Vehicle Collision Analysis," ARA Technical Report, June 2005.
15. Kirkpatrick, S. W., "Analysis of the Tank Car Response in the Minot ND Derailment," ARA Technical Report, June 17, 2005.
16. Walker, R., Laine, K.J., and Kirkpatrick, S. W., "Crashworthy GS Coach Ramp Platen Test," Transportation Technology Center, Inc., (TTCI) Technical Report, June 2005.
17. Kirkpatrick, S. W., "Development of a Modified Crashworthy GS Coach Car for Indian Railway – GS Coach Design Report," ARA Technical Report, April 2005.

18. S.W. Kirkpatrick, "Lumped Mass Collision Dynamics Analyses for Indian Railway," Technical Report, March 23, 2005.
19. Kirkpatrick, S. W., "Development of a Modified Crashworthy GS Coach Car for Indian Railway," ARA Interim Technical Report, November 8, 2004.
20. Kirkpatrick, S. W. and R. A. MacNeill, "Force Protection - Structural Damage Assessments," ARA Technical Report, Project 5173, July 2003
21. Kirkpatrick, S. W., R. T. Bocchieri, and R. MacNeill, "Analysis of a High-Speed Penetrator Impacting a Concrete Target Using the LS-DYNA Finite Element Code," ARA Technical Report, Project 5707, May 2003.
22. Kirkpatrick, S. W., R. T. Bocchieri, "Finite Element Analysis of the LifeNet SoftWalls Barrier Concept," ARA Final Report, Project 5603 for McMurry & Talbott, Attorneys at Law, May 2003.
23. R.W. Klopp, S.W. Kirkpatrick, and D.A. Shockey, "Damage Assessment of Tank Cars Involved in Accidents: Phase II - Modeling and Validation," DOT/FRA/ORD-0204, December, 2002.
24. M. Kleinberger, E. Ward, and S.W. Kirkpatrick, "Commuter Rail Passenger Seat Design Incorporating Lap and Shoulder Belts: Engineering Model Design Development," Final Technical Report, Volpe National Transportation Systems Center, October 2002.
25. MacNeill, R.A., and Kirkpatrick, S.W., "Documentation of Deformation From Impact Of Full-Scale Two-Car Train Test," ARA Final Report for Volpe National Transportation Systems Center, 2002.
26. Holmes, B. S., S. W. Kirkpatrick, and R. MacNeill, R. T. Bocchieri, "Space Based Laser Lethality and Target Hardening Support for BMDO," ARA Technical Report, Project 0724 for BMDO/DE, September 2002.
27. Kirkpatrick, S.W. MacNeill, R.A. and Schroeder, M., "Development of a Computer Model for Prediction of Car Crush and Gross Motion of a Railroad Passenger Car Under Collision Conditions," Final Report, Volpe National Transportation Systems Center, 2001.
28. R.W. Klopp, S.W. Kirkpatrick, and D.A. Shockey, "Damage Assessment of Tank Cars Involved in Accidents: Phase II - Modeling and Validation," Final Report, June, 1999.
29. S.W. Kirkpatrick and T.H. Antoun, "Development and Validation of a Vehicle Crash Model for the 1997 Ford Crown Victoria" SRI Final Report, SRI Project No. 2451 (April, 1999).
30. S. W. Kirkpatrick, 1999, "Damage and Failure Behavior of Metal Matrix Composites under Biaxial Loads," Ph.D. Thesis, Stanford University.
31. J.D. Colton, S.W. Kirkpatrick, and T. Cooper, "Experiments and Calculations in Support of Code Development for Engineering Lethality," SRI Final Report, Project PYU-2351, December, 1998
32. S. W. Kirkpatrick, 1999, "Damage and Failure Behavior of Metal Matrix Composites under Biaxial Loads," SRI International Final Technical Report, SRI Project No. PYU-1304, Prepared for the Air Force Office of Scientific Research, Contract No. F49620-96-C-0051, September 1998.
33. J.D. Colton, P.R. Gefken, D.C. Erlich, S.W. Kirkpatrick, and R.W. Klopp, "Further Development of Load-Damage Relationships for Chemical Submunitions" Final Report, December 1997.
34. R.W. Klopp, S.W. Kirkpatrick, and D.A. Shockey, "Damage Assessment of Tank Cars Involved in Accidents: Phase II - Modeling and Validation," Final Report, December 1997.
35. S.W. Kirkpatrick, T.H. Antoun, and J.W. Simons "Development of a DYNA3D Crash Model for the 1997 Ford Crown Victoria" Final Report, December 1997.
36. J.W. Simons and S.W. Kirkpatrick, "Risk assessment for High-Speed Train Derailment: Detailed Finite Element Model of a Train Car" Technical Report, February 1997.

37. S.W. Kirkpatrick and J.W. Simons, "Hazard Risk of High-Speed Train Derailment: Modeling Train Set Derailment on an Elevated Guideway" Technical Report, November 1996.
38. S.W. Kirkpatrick and J.W. Simons, "Computational and Graphical Methods for Impact Analyses." Final Technical Report, November 1996.
39. M. Snyder, D. Allen, S.W. Kirkpatrick, J.W. Simons, W. Peacock and K. Spezzaferro, "Case Studies in Collision Safety," U.S. Dept. of Trans., Federal Railroad Administration, June 1996.
40. J.W. Simons and S.W. Kirkpatrick, "High-Speed Rail Collision Safety: Crashworthiness and Accident Survivability," Poulter Laboratory Technical Report 001-96 (June 1996).
41. D.A. Shockey, C.G. Schmidt, S.W. Kirkpatrick, and T. Kobayashi, "Damage and Failure Behavior of SiC SCS-6/Timetal 21S Metal Matrix Composite," Final Technical Report, Air Force Office of Scientific Research, March 1996.
42. R.W. Klopp, S.W. Kirkpatrick, J.W. Simons, and D.A. Shockey, "Hazard Risk of High-Speed train Derailment," Final Report, January 1996.
43. J. D. Colton, C. M. Romander, S. W. Kirkpatrick, A. L. Florence, and J. H. Giovanola, "Load-Damage Relationships for Chemical Submunitions," Report No. DNA-TR-96-19, October 1996.
44. S. W. Kirkpatrick and J. H. Giovanola, "Thermomechanical Models and Tests of Laser Effects," Defense Nuclear Agency, DNA-TR-95-16, Contract DNA 001-92-C-0096, January 1995.
45. J. H. Giovanola, S. W. Kirkpatrick, J. E. Crocker, and D. C. Erlich, "Analysis and Modeling of Fracture in Steel and Titanium Weldments," Final Technical Report, January 1993.
46. S. W. Kirkpatrick, "ASAT SELT4 Test," Technical Report, General Research Corporation, November 1992.
47. B. S. Holmes and S. W. Kirkpatrick, "Finite Element Model for Side Impact Dummy (SID)," PRC, Inc. Subcontract TSC-1, October 1992.
48. J. H. Giovanola, and S. W. Kirkpatrick, "Failure Analysis of Ring-Stiffened Cylinders (U)," Technical Report, May 1992.
49. B. S. Holmes, S. W. Kirkpatrick, and J. K. Gran, "Postboost Vehicle Response (LTH-3)," Defense Nuclear Agency, DNA-TR-91-183, March 1992.
50. J. H. Giovanola, D. R. Curran, T. Kobayashi, R. W. Klopp, S. W. Kirkpatrick, and D. C. Erlich, "Modeling of Microstructural Effects on Fracture Processes at High Loading Rates: Dynamic Fracture Observations in High Strength Steels," Technical Report, January 1992.
51. S. A. Miller, A. L. Florence, and S. W. Kirkpatrick, "Formation and Propagation of Love Waves from a P-Wave Source," Phillips Laboratory, PL-TR-92-2034, January 1992.
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Professional Bio

Steven W. Kirkpatrick

After graduation from U.C. San Diego with a B.S. in Applied Mechanics and U.C. Berkeley with an M.S. in Mechanical Engineering, Dr. Steven Kirkpatrick joined SRI International (formerly the Stanford Research Institute) as a Research Engineer in the Shock Physics and Engineering Mechanics Group. At SRI, Dr. Kirkpatrick contributed to and managed research projects for a diverse range of topics including blast and impact response of structures, crashworthiness and transportation safety, and lethality assessments of ground and spaced based structures.

While at SRI, Dr. Kirkpatrick enrolled in, and completed, his Ph.D. in Mechanical Engineering at Stanford University. His research thesis was related to the characterization of the mechanical and failure behavior of Metal Matrix Composites. Dr. Kirkpatrick developed an extensive background in mechanics of composites through his close association with the Stanford University Composites and Structures Group.

In 1999 Dr. Kirkpatrick accepted a position at Applied Research Associates, Inc. as a Senior Research Engineer. Dr Kirkpatrick managed the ARA research program in crashworthiness, eventually resulting in the U.S. Department of Transportation Federal Highway Administration designation of ARA as a Center of Excellence in Finite Element Crash Analysis. The Center of Excellence, with Dr. Kirkpatrick as director, performs analysis and development of roadside hardware and analysis of vehicle response and motions from impacts with roadside structures.

In 2003 through 2005, Dr Kirkpatrick was the Principal Investigator at ARA contributing to the National Institute of Standards and Technology (NIST) sponsored investigation into the dynamic response and damage produced by the aircraft impacts into the World Trade Center Towers. The ARA research effort was responsible for the determination of the aircraft impact damage to the towers including the distribution of fuel and aircraft debris.



- Clearance Level: Secret
- Computer Languages: Fortran

- Patents:

Patent No.: US 6,298,763 B1

Date: Oct. 9, 2001

Explosive device neutralization system

Inventors: G. Greenfield, B. Peterson, P. Gefken, T. Henry, S. Kirkpatrick

Assignee: USA, Navy

- Capability-based experience: Crashworthiness and transportation safety; occupant kinematics and injury assessment; applied mechanics; finite element analysis; structural dynamics; dynamic buckling; mechanics of composite materials.