
Kirsten M. Carr, Ph.D.

KCarr@CarrAnalysis.com

PROFESSIONAL EXPERIENCE

Carr Analysis, LLC – Ann Arbor, MI

President and Principal Consultant

May, 2011-present

Expert in mechanical and manufacturing engineering, with specific expertise in forensic analysis of mechanical components, industrial equipment, electromechanical systems, vehicle occupant protection systems. Additional expertise in manufacturing quality control, failure analysis, durability and fatigue analysis, statistical data analysis, and component testing. Experience in patent validity and infringement matters. Software development with experience in database design and full-stack development using Python, Django, JavaScript, and PostgreSQL.

Packer Engineering, Inc. – Ann Arbor, MI

Director

2006-May, 2011

Responsible for managing and performing mechanical and manufacturing engineering investigations and analyses for legal, insurance, and industrial firms.

Ford Motor Company – Dearborn, MI

Supervisor, Powertrain Forward Model Quality

2004-2006

Lead engine and transmission engineering teams in the technical design robustness evaluation of new designs and design changes. Developed and taught a full-day technical course on design robustness to nearly 1,500 engineers.

Supervisor, Core and Advance Safety Sensors

2000-2004

Responsible for creating, staffing, and directing a team of mechanical and electrical engineers tasked with managing the safety sensors (front impact, occupant classification, side impact, rollover, and pre-crash) available to vehicle programs, including performance requirements and specifications, electrical architecture, testing and delivering new sensor technologies, providing vehicle program support, and supporting corporate-level interactions with government agencies and consortia. Delivered occupant classification capability to meet new FMVSS regulations, including authoring performance specifications and delivering multiple sensor technologies. Integrated pre-crash and occupant sensors into vehicle for live demonstrations of controlling seatbelt and airbag systems based on these sensor inputs. Co-invented and patented advanced rollover sensor algorithm.

Technical Specialist, Occupant Safety Research 1997-2000
Invented new vehicle safety devices for the occupant compartment with a focus on seat belt technology and seat technology.

Technical Specialist, Manufacturing Research 1996-1997
Developed and validated machining simulation models and dimensional management and tolerancing technologies.

Product Engineer, Automatic Transmission 1995
Responsible for testing regarding the contribution of the automatic transmission to vehicle noise-vibration-harshness and powertrain temperature management of thermal loads.

Prototype Build Manager, F-Series Prototype Build 1995
Responsible for the assembly of prototype vehicle interiors at the prototype vehicle plant, including maintenance of proper part levels to meet vehicle crash safety testing.

Research Engineer, Manufacturing Research 1992-1995
Developed algorithms to verify the dimensional quality of parts to specified geometric dimensioning and tolerancing using three-dimensional inspection data.

ACADEMIC

Ph.D. Mechanical Engineering, University of Illinois (Urbana, IL), 1995
M.S. Mechanical Engineering, University of Illinois (Urbana, IL), 1990
B.S. Mechanical Engineering, University of Michigan (Ann Arbor, MI), 1987

CONTINUING EDUCATION

- Vehicle Accident Reconstruction Methods, SAE (2008)
- Traffic Accident Reconstruction II, Northwestern University Center for Public Safety (2007)
- Injuries, Anatomy, Biomechanics & Federal Regulation, SAE (1999)
- Ergonomics in Vehicle Design, Ford Corporate Design Course (1999)
- SAE Government/Industry Meeting – Directions for the 21st Century (1998)
- Sport Utility/Light Truck Vehicle Safety TOPTEC, SAE (1997)
- Practical Principles of Metal Machining & Cutting Tools, Lehigh University (1996)

ACHIEVEMENTS

PATENTS

Methods for Detecting Vehicle Rollover
US Patent 8014922 (9/2011)
Four Point Seat Belt System
US Patent 7625048 (12/2009)

Methods and Systems for Detecting Automobile Rollover
US Patent 7522982 (4/2009)
Occupant Classification Sensor Calibration System
US Patent 7457692 (11/2008)
Audio Noise Cancellation System for a Sensor in an Automotive Vehicle
US Patent 7127073 (10/24/2006)
Kinetic Energy Density Rollover Detective Sensing Algorithm
US Patent 6856868 (2/2005)
Programmable Seat Belt Damper Assembly
US Patent 6705559 (3/2004)
Programmable Seat Back Damper Assembly for Seats
US Patent 6601915 (8/2003), US Patent 6312049 (11/2001)
Seat Belt Restraint System
US Patent 6375270 (4/2002)

PROFESSIONAL REGISTRATION

Licensed Professional Engineer, State of Michigan (License No. 6201054930)
National Council of Examiners for Engineering and Surveying (NCEES) (No. 36470)

AFFILIATIONS

Society of Automotive Engineers (SAE)
American Society of Mechanical Engineers (ASME)
Society of Women Engineers (SWE)

PUBLICATIONS and PRESENTATIONS

1. Lichtenberg, G. and Carr, K., "Performance Evaluation of Occupant Classification Systems," *International Mechanical Engineering Congress and Exposition*, IMECE 2004-60132, AMD-Vol. 255, 2004.
2. Natalini, T., Carr, K., Vala, M., and Boroughf, W., "Variables Influencing Shoulder Belt Positioning of Four Point Safety Belts," *Society of Automotive Engineers Technical Paper* 2001-01-0382, 2001.
3. Carr, K.M., Rodin, Y.M., and Smith, G.H., "Methodology for Detecting and Measuring Workpiece Distortion Caused by Fixture Clamping Forces," *International Mechanical Engineering Congress and Exposition*, MED-Vol 8, 1998.
4. Carr, K.M. and Ferreira, P.M., "Verification of Form Tolerances, Parts I & II: Basic Issues, Flatness, and Straightness; Cylindricity, Circularity, and Straightness," *Precision Engineering, American Society for Precision Eng.*, Vol. 17, April 1995.
5. Carr, K.M. and Ferreira, P.M., "Verification of Form Tolerances Using Point Data," *American Society of Precision Engineering*, Ninth Annual Meeting, Vol. 10, October 1994.
6. Carr, K.M., Erickson, K., and Ferreira, P.M., "Obstacle Avoidance for Redundant Robots," *North American Manufacturing Research Proceedings*, 1990.

REPORTS

1. Carr, K.M. and Sullivan, J.L., "Impact Testing of Magneto-Rheological Fluid Dampers for Safety Applications," *Technical Report No SRR-2000-0059*, 2000.
2. Sullivan, J.L. and Carr, K.M., "Interior System Energy Absorption During Vehicular Crashes: A Review," *Technical Report No SRR-2000-0011*, 2000.
3. Carr, K.M., "Review of Four Point Safety Belt Patents," 2000.
4. Carr, K., T. Natalini, "Human Factors Dynamic Drive Test Evaluation of Suspender-Style Four-Point Safety Belt System," 2000.
5. Carr, K.M., "Vehicle Safety Technologies: A Review of Basic and Advanced Vehicle-Implemented Safety Technologies," *Technical Report No SRR-1999-0017*, 1999.
6. Carr, K.M., Rodin, Y.M., Smith, G.H., "Methodology for Detecting and Measuring Workpiece Distortion Caused by Fixture Clamping Forces," *Technical Report No SRR-1998-017*, 1998.
7. Carr, K.M. and Ferreira, P.M., "Verification of Form Tolerances, Part II: Cylindricity, Circularity, and Straightness," *Technical Report No SR-94-14*, 1994.
8. Carr, K.M. and Ferreira, P.M., "Verification of Form Tolerances, Part I: Basic Issues, Flatness, and Straightness," *Technical Report No SR-94-13*, 1994.

LECTURES

1. Carr, K.M., "Safety Application of Magneto-Rheological Dampers," guest lecture to the Active Automotive Safety Systems graduate-level class at University of Michigan – Dearborn, December 1999.
2. Carr, K.M., "Modeling and Verification Methods for the Inspection of Geometric Tolerances Using Point Data," guest lecturer at Manufacturing Research Seminar Series, University of Michigan – Ann Arbor, February 1997.

PROFESSIONAL ACTIVITIES

- Committees: ASME Y14.5.1: Mathematical Definition of Dimensioning and Tolerancing Principles (1994-1998), ASME Manufacturing Engineering Division: Professional Development Chair (1998-2000)
- Manuscript reviewer: *ASPE Precision Engineering Journal*, *ASME Journal of Manufacturing Science and Engineering*, *IIE Transactions on Design and Manufacturing*
- Proposal Reviewer: National Science Foundation Machine Tool Agile Manufacturing Research Institute, National Science Foundation Industry/University Cooperative Research Centers, Consortium on Deburring and Edge Finishing, National Science Foundation Engineering Research Center for Reconfigurable Manufacturing Systems, Ford Motor Company University Research Program
- Session Chair/Conference Paper Reviewer: ASME International Mechanical Engineering Congress and Exposition, National Manufacturing Week, North American Manufacturing Research Institute of Society of Manufacturing Engineering, American Society of Precision Engineering Annual Meeting