

Peter J. Schuster

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- Education**
- Ph.D. Mechanical Engineering (Biomechanics), Michigan Technological University, 2000
Dissertation: "Evaluation of the Real-World Injury-Reduction Potential of the Proposed European Pedestrian 'Leg-Form' Impact Test Using a Detailed Finite Element Model of the Lower Limb"
 - M.S. Mechanical Engineering (Design), Stanford University, 1992
 - B.A. Physics, Cornell University, 1991 (Magna Cum Laude)
with honors and distinction in all subjects

Employment History **California Polytechnic State University: San Luis Obispo, CA** *Jan 2003 – present*

Associate Professor, Mechanical Engineering (9/06 – present)

Assistant Professor, Mechanical Engineering (1/03 – 8/06)

Teaching undergraduate and graduate courses in engineering mechanics, design, stress analysis, and finite element methods. Course-related activities include developing syllabi, lectures, homework, exams, and laboratory and in-class exercises; presenting all materials, and grading student work. Research interests include vehicle safety, numerical biomechanics, and design of vehicle structures.

San Luis Obispo County District Attorney: San Luis Obispo, CA *Jun 2004 – Aug 2004*

Consultant: Performed vehicle accident analysis investigation for pending criminal case.

Ford Motor Company: Dearborn, Michigan *Jul 1992 – Dec 2002*

Principal Technical Specialist, Jaguar Research, United Kingdom (7/01 – 12/02) – Team leader of a \$6 million project to develop two industry-leading pedestrian-friendly vehicles by a team of Ford, Jaguar, Mazda, and Volvo engineers. Responsible for research direction, project deliverables, system interactions, budget, and team motivation. Developed strategic vision and reorganization plan for all future Ford pedestrian safety activities.

Technical Specialist – Pedestrian Protection (3/00 – 7/01) - Managed international team to develop pedestrian-friendly bumpers, hoods, and fenders. Trained and supervised engineers. Developed and validated a human lower limb finite element (FE) model. Technical consultant to government lobbyists. Developed project plan, formed team, and obtained funding for the new Global Pedestrian Safety Project (see above).

Safety CAE Engineer (4/98 – 2/00) – Responsible for Ford pedestrian safety CAE.

Developed dynamic non-linear FE analyses and CAD tools for pedestrian impacts. Used CAE methods to develop improved pedestrian safety on two new vehicles. Trained engineers in pedestrian safety CAE. Developed knowledge-based engineering tool.

Exterior Design Engineer (8/94 – 3/98) – Developed bumper systems for four vehicles, including federal impact certification. Conducted research in chemical treatments, materials, and safety. Established system performance specifications and test procedures. Developed design guidelines for pedestrian impact based on designed experiments and FEA. Assisted in the development of new bumper design strategies and tools.

Ford College Graduate Program (7/92 – 7/94) – Rotations through design, manufacturing, and development engineering, including: Structural FEA, recycled bumper materials, vehicle weight and noise reduction, and a new chassis assembly line.

- Employment History, con't.** **Cornell University: Ithaca, New York** *Jan 1989 – Aug 1991*
 Part-time and summer positions in math (Grader 8/88-5/89), physics (Research Assistant 8/88-5/89, Teaching Assistant 8/90-5/91), and astronomy (Research Assistant 5/88-8/88, 6/89-8/91) departments.
- Publications - Journals**
 Roussel S, Porumamilla H, Birdsong C, Schuster P, “Modeling of vehicle magnetic footprint in 3-D space for type detection” to be submitted to *IEEE Sensors Journal*, November 2008.
 Aekbote K, Schuster PJ, Kankanala SV, Sundararajan S, Rouhana SW, “The biomechanical aspects of pedestrian protection.” *Recent Research and Development on Vehicle Safety*, an edition of the *International Journal of Vehicle Design* **31**: 1/2, 2003.
 Schuster PJ, Jayaraman G, Chou CC, Prasad P, “Development and validation of a pedestrian lower limb non-linear 3-D finite element model.” *Stapp Car Crash Journal* **44**, 2000.
- Publications - Conferences**
 Schuster P, Birdsong C, “TRB safety IDEA: Sensor integration for low-cost crash avoidance,” Poster presentation at *TRB Annual Meeting*, January 2009.
 Schuster P, Birdsong C, “Undergraduate research: Experiences from a three-year project.” *Proceedings, 2007 ASME International Mechanical Engineering Congress*, Nov. 2007.
 Desrosiers D, Birdsong C, Schuster P, “A pre-crash simulator to evaluate vehicle collision prediction algorithms.” *Proceedings, Fifth IFAC (International Federation of Automatic Control) Symposium on Advances in Automotive Control*, August 2007.
 Davis J, Schuster P, “Development of a biofidelic ‘legform’ impact test device.” *SP-2123: Safety Test Methodology 2007*, SAE, April 2007.
 Schuster P, Birdsong C, “Research in the undergraduate environment.” *Proceedings, 2006 ASEE Annual Conference*, June 2006.
 Schuster P, Davol A, Mello J, “Student competitions – the benefits and challenges.” *Proceedings, 2006 ASEE Annual Conference*, June 2006.
 Birdsong C, Schuster P, Carlin J, Kawano D, Thompson W, “Test methods and results for sensors in a pre-crash detection system.” *SP-2027: Intelligent Vehicles & Transportation Systems*, SAE, April 2006.
 Krone R, Schuster P, “An investigation on the importance of material anisotropy in FE modeling of the human femur.” *SP-1995: Biomechanics 2006*, SAE, April 2006.
 Schuster P, “Current trends in bumper design for pedestrian impact.” *Proceedings, 2006 SAE World Congress*, April 2006.
 Carlin J, Birdsong C, Schuster P, Thompson W, Kawano D, “Evaluation of cost effective sensor combinations for a vehicle pre-crash detection system.” *Proceedings, 2005 SAE Commercial Vehicle Conference*, November 2005.
 Farooq SI, Schuster PJ, “Body concept design for pedestrian head impact.” *SP-1774: CAE Methodology for Vehicle Crash Safety*, SAE, 2003.
 Hassan J, Schuster P, Frederick G, “Use of polyurethane material models for simulating leg-form impact in different explicit finite element codes.” *Proceedings, International Body Engineering Conference*, SAE, 1998.
 Schuster PJ, Staines B, “Determination of bumper styling and engineering parameters to reduce pedestrian leg injuries.” *SAE SP-1355: Mechanics of Protection*, 1998.
 Frederick G, Kaapp G, Kudelko K, Schuster PJ, Domas F, Haardt UG, Lenz W, “Optimization of expanded polypropylene foam coring to improve bumper foam core energy absorbing capability.” *Proceedings, 1995 SAE World Congress*, 1995.

- Publications - Other**
- Birdsong C, Schuster P, “TRB safety IDEA project stage 1 report: Sensor integration for low-cost crash avoidance,” for the Transportation Research Board, August 2008.
- Negrete E, Schuster P, “AISI/Cal Poly impact test system reliability: Ford F-150 front bumpers,” for AISI, 2008.
- Schuster P, “Hot topic: More than just engines and tires,” *Junior Engineering Technical Society (JETS) Pre-Engineering Times* **55**, February 2007.
- Schuster P, “Inspection report: Horse trailer door,” for San Luis Obispo County District Attorney, 2004.
- Schuster P, “Bumper design for pedestrian impact: A review of design concepts,” for AISI, 2004. Published on website and distributed at exhibitions.
- Research Projects**
- Exercise Biomechanics (2007-present). Develop a computational method to predict localized bone remodeling activity based on specific exercise activities. Supported by the California Central Coast Research Partnership (C3RP). 5 graduate students.
- Bumper Impact Design & Testing (2004-present). Develop bumper systems for specific applications: (a) enhanced impact performance and (b) adaptable designs for global market performance. In parallel, develop a low-cost bumper impact test system. Supported by the American Iron and Steel Institute (AISI). 3 graduate and 20 undergraduate students.
- Vehicle Pre-Crash Sensing (2004-present). Develop a system for predicting a vehicle impact before it occurs, by fusing the outputs of several exterior sensors. Supported by the Transportation Research Board (TRB), C3RP, Lockheed Martin, Delphi Automotive, and Tyco Electronics. 4 graduate and 19 undergraduate students.
- Human Lower Limb Surrogates (2004-2005). Develop a new lower limb FE model and test surrogate to predict the injury risk of lower limb impacts. Supported by CSU FDGP, C3RP, and Innovation Q. 2 graduate and 4 undergraduate students.
- Research Funding**
- “Impact test system upgrades,” \$7,000, AISI, 2008.
- “Steel bumper for pedestrian impact,” \$5,000, AISI, 2008.
- “MA/COM radar sensors,” \$5,000, Tyco Electronics, 2008.
- “Bumper impact test reliability assessment,” \$5,000, AISI, 2008.
- “Sensor integration for low-cost crash avoidance,” \$137,340, TRB, 2007.
- “Enhancing physical performance through detailed human modeling,” \$49,111, C3RP, 2007.
- “Innovations in design education,” \$15,475, Bently Center, 2007.
- “Global adaptable car front bumper reinforcing system,” \$11,000, AISI, 2007.
- “Bumper design for new IIHS low-speed impact protocol,” \$4,000, AISI, 2007.
- “Bumper impact test system,” \$7,000, AISI, 2006.
- “Knee brace projects,” \$7,500, Townsend Design, 2006.
- “Knee brace attachments,” \$2,000, EVS Sports, 2006.
- “Steel bumper system for pedestrian impact,” \$7,500, AISI, 2006.
- “Integrated object detection system,” \$10,000, Lockheed Martin, 2005.
- “Impact test system for consumer safety devices,” \$13,300, Bently Center, 2005.
- “Legform test device” and “Biofeedback & direct pressure,” \$2,500, Innovation Q, 2005.
- “Development of a truck bumper system for compatibility,” \$20,000, AISI, 2004-05.
- “Vehicle pre-crash sensing,” \$5,000, Delphi Automotive, 2004.
- “Computational mechanics,” \$96,000, Hewlett-Packard, 2004.
- “Survey of pedestrian-friendly bumper designs,” \$7,600, AISI, 2004.
- “The influence of specific exercises on bone remodeling,” \$6,700, Bently Center, 2004.
- “Sensing system for automatic human detection,” \$54,000, C3RP, 2004.
- “Biomechanical ‘leg-form’ for pedestrian impact tests,” \$33,750, C3RP, 2004.
- “Lower limb finite element model,” \$4,100, CSU State Faculty Support Grant, 2004.

Awards & Achievements	Professional Engineer (Michigan), 1997 – present Ford Motor Company Customer Driven Quality Award, 1996 National Science Foundation Graduate Fellowship, 1991 – 1992 National Science Foundation Undergraduate Research Fellowship, 1988, 1990
Professional Membership	American Society for Engineering Education (ASEE) American Society of Mechanical Engineers (ASME) Society of Automotive Engineers (SAE)
Patents	US6950014: “Method for operating a pre-crash sensor in a veh. w/external airbags” (2005) US6712410: “Extruded aluminum bumper” (2004) US6663151: “Bumper system for motor vehicles” (2003) US6568023, EP1215094: “Wiper pivot” (2003) US6554332, DE10352629: “Pedestrian impact energy mgt. device” (2003) US6513843, GB2385566, DE10304784: “Pedestrian protection leg spoiler” (2003) US6460909, EP1108622, DE60017697: “Bumper system for a motor vehicle” (2002) US6415882, GB2381509: “Deploy. hinge for pedestrian protection vehicle hood” (2002) US6394512, EP1215093, DE60113048: “Vehicle bumper system” (2002) US6089628, EP0983909: “Stiffener assy. for bumper system of motor vehs.” (2000)
Courses Taught	ME 211 – Engineering Statics (lec). Analysis of forces on engineering structures in equilibrium. Equilibrium conditions, friction, centroids, area moments of inertia. ME 234 – Philosophy of Design (lec). Introduction to design methodologies and their application to innovative problem-solving. ME 328 – Introduction to Design (lec & lab). Design principles and strength of materials. Stress, deflection, buckling, failure criteria, impact, and fatigue. ME 329 – Intermediate Design (lec & lab). Design of mechanical systems using machine components: fasteners, power screws, welds, springs, gears, bearings, and clutches. ME 401 – Stress Analysis (lec & lab). Advanced strength of materials: behavior of disks, plates, and shells. Introduction to theory of elasticity and energy methods. ME 404 – Applied Finite Element Analysis (lec & lab). Undergraduate introduction to FEA with emphasis on applications and limitations of the method. ME 428 – Senior Design (lab). Design principles applied to industry-sponsored projects. ME 481/2 – Senior Project (indep. study). Advisor for senior undergraduate students. ME 502 – Finite Element Analysis (lec & lab). Graduate introduction to FEA with emphasis on the underlying theory of linear static methods. ME 599 – Thesis (indep. study). Advisor and committee member for master’s students.
Graduate Students	Thesis advisor for 11 graduate students (7 complete, 3 in progress) Committee member for 14 additional graduate students (9 complete, 5 in progress)
Service Activities	Advisor, Cal Poly Engineering Learn-by-Doing Lab (2008-present). Academic Advisor. Providing support with academic or personal issues for 50 ME students. Academic Committees. Serving on various department and college committees. Co-advisor, Society of Automotive Engineers (SAE) Cal Poly student chapter (2003-2007). Largest CA chapter. Professional activities, Formula SAE, Mini Baja, & SuperMileage. Paper reviewer for: ASEE, ASME, ImechE, and SAE (1998-present) NIOSH proposal reviewer (2006). Mentor for two students in MentorNet’s Women in Engineering program (1999 – 2002)