Exponent
Failure Analysis Associates®

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Richard W. Klopp, Ph.D., P.E.
Senior Managing Engineer

Professional Profile

Dr. Richard W. Klopp is a Senior Managing Engineer in Exponent's Mechanical Engineering practice. Dr. Klopp specializes in mechanical engineering and the mechanics of materials. He has particular expertise in laboratory-based testing, mechanical design, failure analysis and prevention, and manufacturing. His mechanical engineering background includes extensive experience in machining; machinery; analysis of fasteners, gears, and bearings; power transmission; optical systems; metrology; and fluid handling components. His mechanics of materials background includes extensive experience in fracture mechanics, high strain rate deformation and failure, impact and shock wave loading, mechanical testing and optical measurement methods.

Dr. Klopp has applied his expertise to machine tools, industrial machinery, laser systems, automobiles, trucks, potable, fire protection, and wastewater system components, plumbing, computer equipment, electronic packaging, consumer products, medical equipment and medical devices, toys, recreational products, railroad tank cars, chemical storage tanks, underground tunnels, armor/antiarmor, and missile defense. Dr. Klopp has studied the mechanical behavior of metals, ceramics, rock, plastics, advanced composites, liquids, and wood.

Dr. Klopp has provided consulting services on matters of industrial problem solving, product recalls, product defect litigation, intellectual property disputes, national defense, and insurance issues.

Dr. Klopp is a skilled machinist qualified to set up and operate machine tools such as lathes, milling machines and other shop equipment. His personal machine shop is equipped with a computer numerical control (CNC) milling machine, two manual milling machines, two toolroom lathes, grinders, and a wide variety of supporting tooling and equipment.

Prior to joining Exponent, Dr. Klopp was a Research Engineer at SRI International and worked as a Research Associate at Brown University.

Academic Credentials and Professional Honors

Ph.D., Engineering, Brown University, 1987
Sc.M., Applied Mathematics, Brown University, 1986
Sc.M., Engineering, Brown University, 1984
B.S., Mechanical Engineering, Lehigh University, 1981

SRI International Postdoctoral Fellowship; University Fellowship, Brown University; Ingersoll Rand Award; Alfred Stenning Award

Licenses and Certifications

Registered Professional Mechanical Engineer, California, #M31530

Publications

Klopp RW. Failure analysis of redundant escalator chain pin retention mechanisms. Proceedings of the ASME 2011 International Mechanical Engineering Congress & Exposition (IMECE2011), Denver, CO, ASME, November 11–17, 2011.

Klopp RW, Dugnani R, Edmonds JS. The role of brush spring kinking in a generator flash-over incident. Proceedings, 43rd North American Power Symposium (NAPS2011), Boston, MA, IEEE, August 4–6, 2011.

Tokheim RE, Cooper T, Lew B, Klopp RW, Groethe MA, Peterson RR, Williamson D, Blanchard JP. Computational modeling of Z plasma-radiation-source debris. J Radiat Eff Res Eng 2004; 20(1).

Duffner DH, Klopp RW, Wagner-Jauregg A, Sire RA, Webster EM. Component damage from printed circuit board loading. Proceedings, IPC Printed Circuits Expo 2002, Long Beach, CA, IPC, pp. S12-4-1–S12-4-8, March 2002.

Kirkpatrick SW, Klopp RW. Hazard assessment for pressure tank cars involved in accidents. Proceedings, International Crashworthiness Conference (Icrash), London, UK, Chirwa EC and Otte D (eds), pp. 223–235, September 6–8, 2000.

Kobayashi T, Shockey DA, Schmidt CG, Klopp RW. Assessment of fatigue load spectrum from fracture surface topography. Int J Fatigue 1997; 19(1):S237–S244.

Klopp RW, Florence AL, Simons JW, Gran JK. Spherical Wave interaction with cylindrical holes in large limestone specimens. J de Physique IV, Colloque C8, supplément au Journal de Physique III, 1994; 4:735–740.

Klopp RW, Crocker JE. A dynamic fiber push-out test applied to metal-matrix composites. J de Physique IV, Colloque C8, supplément au Journal de Physique III 1994; 4:47–51.

Klopp RW, Crocker JE. Dynamic fracture behavior of SCS-6/Ti-15-3 metal-matrix composite. Int J Fract 1993; 61(R77–R83).

Klopp RW, Shockey DA. The strength behavior of granulated silicon carbide at high strain rates and confining pressure. J Appl Phys 1991; 70(12):7318–7326.

Giovanola JH, Klopp RW, Kirkpatrick, SW, McDonald WW. Dynamic fracture of welded joints. J. de Physique, Colloque C3; 1991 1(suppl. III):565–572.

Klopp RW, Shockey DA, Osher JE, Chau HH. Characteristics of hypervelocity impact debris clouds. Int J Impact Eng 1990; 10(1–4):323–335.

Klopp RW, Clifton RJ. Analysis of tilt in the high-strain-rate pressure-shear plate impact experiment. J Appl Phys 1990; 67(11):7171–7173.

Giovanola JH, Kobayashi T, Klopp RW, Gaines T, Arwood R. A note on dynamic displacement measurement using Hall Effect sensors. J Test Eval 1989; 17(3):196–200.

Klopp RW, Clifton RJ, Shawki T. Pressure-shear impact and the dynamic viscoplastic response of metals. Mech Mater 1985; 4(3&4):375–385.

Reports

Klopp RW, Kirkpatrick SW, Shockey DA. Damage assessment of tank cars involved in accidents: Phase II—modeling and validation. Final Report DOT/FRA/ORD-02/04, Federal Railroad Administration, Office of Research and Development, 2002.

Klopp RW, Shockey DA, Curran DR, Cooper T. A granular flow model for developing smart armor ceramics. Final Report to Army Research Office on Contract DAAH04-94-K-0001, January 1998.

Book Chapters

Kirkpatrick SW, Klopp RW. Risk assessment for damaged pressure tank cars. In: Computer Technology and Applications, PVP-Vol. 458. ASME, New York, NY, 2003.

Giovanola JH, Klopp RW, Crocker JE, Alexander DJ, Corwin WR, Nanstad RK. Using small cracked round bars to measure the fracture toughness of a pressure vessel steel weldment: A feasibility study. In: Small Specimen Test Techniques, ASTM STP 1329. Corwin WR, Rosinski ST, van Walle E (eds), ASTM, Philadelphia, PA, 1998.

Giovanola JH, Homma H, Lichtenberger M, Crocker JE, Klopp RW. Fracture toughness measurements using small cracked round bars. In: Constraint Effects in Fracture: Theory and Applications, ASTM STP 1244. Kirk M, Bakker A (eds), ASTM, Philadelphia, PA, 1994.

Klopp RW, Shockey DA, Seaman L, Curran DR, McGinn JT, de Resseguier T. A spherical cavity expansion experiment for characterizing penetration resistance of armor ceramics. In: Mechanical Testing of Ceramics and Ceramic Composites, AMD-Vol. 197. ASME, New York, NY, 1994.

Curran DR, Seaman L, Klopp RW, de Resseguier T, Kanazawa C. A granulated material model for quasibrittle solids. In: Fracture and Damage in Quasibrittle Structures. Bazant ZP, Bittnar Z, Jirásek M, Mazars J (eds), E.& F.N. Spon, London, 1994.

Clifton RJ, Klopp RW. Pressure-shear impact testing. In: Metals Handbook, Vol. 8, 9th Edition. ASM International, Metals Park, OH, 1985.

Presentations and Published Abstracts

Klopp RW, Curran DR, Shockey DA, Cooper T. A comminution model for penetration in ceramics. Proceedings, 14th U.S. Army Symposium on Solid Mechanics, Chou SC, Iyer K (eds), Myrtle Beach, SC, October 16–18, 1996.

Giovanola JH, Klopp RW, Touzé P. Microdamage observations in dynamically fractured Ti-10V-2Fe-3Al microstructures and preliminary modeling attempts. Proceeding, IUTAM Symposium on Micromechanics of Plasticity and Damage of Multiphase Materials, Pineau A, Zaoui A (eds), Sèvres, France, August 29–September 1, 1995, Kluwer Academic Publishers, Dordrecht, 1996.

McGinn JT, Klopp RW, Shockey DA. Deformation and comminution of shock-loaded α-Al_2O_3 in the Mescall zone of ceramic armor. Proceedings, Materials Research Society 1994 Fall Meeting, Symposium on Grain-Size and Mechanical Properties—Fundamentals and Applications, Grant NJ, Armstrong RW, Otooni MA, Baker TN, Ishizaki K (eds), Materials Research Society, Pittsburgh, PA, 1995.

Kirkpatrick SW, Curran DR, Erlich DC, Klopp RW. Three-dimensional analyses of plate impact experiments with circular and star geometries. In: Shock Waves in Condensed Matter, Proceedings, APS '91 Topical Conference, Williamsburg, VA, Schmidt SC, et al. (eds), Elsevier, New York, NY, 1992.

Giovanola JH, Klopp RW, Simons JW. Effect of shear lips on dynamic crack propagation. In: Dynamic Fracture, Proceedings, OJI International Seminar on Dynamic Fracture, Toyohashi, Japan, August 1–4, 1989.

Giovanola JH, Klopp RW, Shockey DA, Werner AT. Effect of microstructure and loading rate on the fracture behavior of Titanium–10V–2Fe–3Al. In: Advances in Fracture Research, Proceedings, 7th International Conference on Fracture (ICF7), Houston, TX, March 20–24, 1989.

Representative Project Experience

Intellectual Property

Analyzed semiconductor wafer chemical mechanical polishing patents. Developed opinions on enablement and written description.

Characterized thermal strains in ball-grid-array semiconductor packages using Moiré interferometry for an International Trade Commission matter. Prepared interferograms that demonstrated infringement.

Characterized the adhesion between coatings and medicines for an IP dispute involving gel-coated pills.

Analyzed laser surgery fiber optic connector patents for infringement and invalidity. Testified in deposition.

Construed claims in gemstone laser micro-inscribing equipment patents and then analyzed them for infringement and invalidity. Testified in deposition, at a Markman hearing, and at trial.

Demonstrated that a patent on granular pesticide morphology claimed a natural phenomenon.

Machine Tools

Demonstrated the impact strength of CNC lathe guard windows by launching simulated workpieces at them using Exponent's automotive crash rail.

Surveyed a large lathe and identified numerous design and manufacturing defects.

Examined and tested a high-speed milling machine to diagnose and resolve an intermittent control fault.

Cranes, Elevators, Escalators, and Mining Equipment

Performed a critical safety assessment of the controls for the cableways used to construct the Mike O'Callaghan – Pat Tillman Memorial Bridge (Hoover Dam Bypass), recommended modifications, and performed extensive testing.

Identified a critical design issue with the tower luffing bearings on the Hoover Dam Bypass cableways, and proposed a solution that avoided dismantling the cranes for repairs.

Determined the root cause of escalator chain failures involving lateral movement of connector pins that ostensibly were press-fit and secured with clips.

Medical Devices and Equipment

Developed special machines to test the durability of neonatal warmer support arms and portable ventricular assist device pneumatic hoses.

Developed a time-lapsed cinematography technique to characterize micron-level motion of an insulin pump plunger at low dosage rates.

Analyzed the effect on dosage accuracy of insulin pump systems subjected to altitude changes.

Water Supply, Wastewater, Natural Gas Piping and Plumbing

Determined that hydraulic jump due to improperly configured waste piping in a 42-story hotel/condominium building was the root cause of sewer backups.

Performed successful field testing of a large sewer line bladder plug in a remote location, coordinating with contractors sight-unseen.

Investigated numerous instances of cracking failure of enameled steel bathtubs used in hotels.

Tested the effect of out-of-tolerance polyethylene gas pipe on the integrity of a wide range of coupling methods.

Determined that water hammer associated with rapid closing of a fire hydrant was the root cause of underground pipe joint failures.

Led a multi-year, multi-million-dollar study on the design, manufacture, and maintenance of fire hydrants and the effect of different food-grade greases on corrosion of the valve operating mechanism.

Automotive Technology and Engines

Analyzed the depreciation of peer brands and models of cars in light of recall publicity.

Developed an analytical model for the behavior of truck power steering systems under impact conditions.

Determined the root cause of cylinder liner cracking in Fairbanks-Morse opposed-piston Diesel and gas engines.

Determined the root cause of the catastrophic failure of a Caterpillar marine engine.

Determined that repeated crankshaft fatigue failures in automobile engines used in an industrial application were due to vibrations peculiar to four-cylinder engines.

Prior Experience

Research Engineer, SRI International Poulter Laboratory, 1987–1999
Postdoctoral Fellow, SRI International Poulter Laboratory, 1986–1987

Professional Affiliations

- American Society of Mechanical Engineers
- SPIE—The International Society for Optical Engineering
- ASM International—American Society for Metals
- American Water Works Association
- Society of Manufacturing Engineers
- Peer reviewer for ASM International *Journal of Materials Engineering and Performance*
- Peer reviewer for ASME *2010 International Design Engineering Technical Conferences (IDETC) and Computers and Information in Engineering Conference (CIE)*

Deposition/Trial Testimony

Depositions

HARSCO Corporation, Claimant, v. Taylor-Wharton International, LLC, Respondent, Arbitration conducted pursuant to Section 10.15 of the November 28, 2007 *Asset and Stock Purchase Agreement* between HARSCO Corporation and Taylor-Wharton International, LLC, August 2009.

Kent Basso and Robin Basso v Shamrock Materials of Novato, Inc., et al., Superior Court of the State of California for the County of Marin, Case No. CV 061576, November 2008.

VSM Group AB v Brother International Corporation, United States District Court for the District of New Jersey, Case No. 07-CV-02553 (FLW/TJB), June, 2008.

Northern Insurance Company of New York v Cummins, Inc., et al., Superior Court of the State of California for the County of Los Angeles, Case No. NC041801, February 2008.

Venture Commerce Center – San Jose Condominium Association v VCC – San Jose, LP, et al. Superior Court of the State of California, County of Santa Clara, Case No. 1-08-CV-130398, August 2011.

Mitchell Engineering v City of Hayward, Superior Court of the State of California, County of Alameda, Case No. HG09483573, November 2011.

Theresa M. Rocha and Shawn Rocha v Payless Mini Storage, et al., Superior Court of the State of California, County of San Joaquin, Case No. 39-2010-00236634-CU-PL-STK, November 2011.

Trials

KB's Express Transportation Services v The Braun Corporation, Circuit Court for the State of Oregon, No. 0707-07662, July 2009.

Lazare Kaplan International v Gemological Institute of America, et al., United States District Court for the Southern District of New York, Case No. 06 CV 4005 (TPG), February 2008.

McWane, Inc., d/b/a Clow Valve Company v Chevron USA, Inc., et al., Iowa District Court for Mahaska County, Case No. LALA074105, October 2008.