Exponent
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Nathan R. Soderborg, Ph.D., CRE, CSSBB

Managing Scientist

Professional Profile

Dr. Nathan R. Soderborg is a Managing Scientist in Exponent's Statistical and Data Sciences practice. He provides consulting services related to statistics, product quality and reliability, process improvement, and mathematical modeling. His experience spans product development and testing, manufacturing, quality assurance, and warranty performance. His work in statistics includes field data and survey analysis, sampling plans, regression, response surface modeling (RSM), reliability and hazard analysis, statistical process control (SPC), and design of experiments (DOE), with a special emphasis on design and analysis of computer experiments (DACE). In addition, he has conducted risk assessments based on stochastic modeling and Monte Carlo simulation. He has an extensive background in process improvement and failure mode avoidance methods, including Six Sigma, Failure Mode and Effects Analysis (FMEA), Voice of the Customer (VOC), Quality Function Deployment (QFD), Robust Design, and Design for Reliability. He is an experienced developer of statistical engineering training and has taught multiple courses related to product quality and reliability improvement methods. His research has focused on how to make practical improvements in product development through effective system engineering, lean failure mode avoidance, and robustness optimization.

As a Six Sigma Master Black Belt at Ford Motor Company, Dr. Soderborg was a primary architect of the company's Design for Six Sigma (DFSS) methodology and deployment. This methodology helps organizations meet customer requirements and prevent failure modes in products through application of state-of-the art product development processes. At Ford, Dr. Soderborg led teams of certified Black Belts in solving problems related to current and future vehicle programs in areas such as safety, NVH, body, chassis, electrical, and powertrain engineering. He trained engineers, mentored management, conducted design reviews, and institutionalized lessons learned across the company. He served as technical chair of the committee that championed analytic reliability and robustness methods and supervised development of software for design and analysis of computer experiments.

Academic Credentials and Professional Honors

Ph.D., Mathematics, University of Michigan, 1991
S.M., Engineering and Management, Massachusetts Institute of Technology, 2002
B.S., Mathematics, Brigham Young University (*magna cum laude, university honors*), 1986

U.S. Department of Education Graduate Fellowship, 1989–1991
Guest Researcher, University of Helsinki, sponsored by National Science Foundation, 1989.
Phi Kappa Phi.
Spencer W. Kimball Presidential Scholarship, BYU, 1981–1986
National Merit Scholarship Finalist, 1981

Licenses and Certifications

ASQ Certified Reliability Engineer, Certificate #4596
ASQ Certified Six Sigma Black Belt, Certificate #1282
Ford Motor Company Certified Six Sigma Master Black Belt

Languages

Finnish

Patents

Patent 7,219,068: Method and System for Product Optimization, May 15, 2007 (with C. Zelek, J. King, M. Vora, T. Brockers).

Patent 6,931,366: Method and Apparatus for Analyzing a Design, August 16, 2005 (with S. Wang, A. Sudjianto, D. Buche, D. Li, M. Vora, S. Jiang, X. Liu).

Patent 5,361,628: System and Method for Processing Test Measurements from a Combustion Engine for Diagnostic Purpose, November 7, 1994 (with K. Marko and B. Bryant).

Patent 5,305,635: System and Method for Filtering a Misfire Detection Data Stream to Yield Optimum Measurement of Misfire Rate, April 26, 1994 (with J. James and T. Feldkamp).

Publications

Lange R, Jacuzzi E, Soderborg N, Pearce H. Injury mitigation technology applications and the relationships to vehicle mass, price, and fuel economy. 22nd International Technical Conference on the Enhanced Safety of Vehicles (ESV), Paper 11-0114, 2011.

Lange R, Soderborg N, Pearce H, Balavich K, Huang S. Side impact airbag efficacy, injury mitigation performance in vehicle models with and without side impact air bags and inflatable head protection. 22nd International Technical Conference on the Enhanced Safety of Vehicles (ESV), Paper 11-0115, 2011.

Balavich K, Soderborg N, Lange R, Pearce H. Deployment characteristics of seat mounted side impact airbags. 22nd International Technical Conference on the Enhanced Safety of Vehicles (ESV), Paper 11-0358, 2011.

Soderborg N. The role of design for six sigma in successful product development. SAE World Congress 2010; SAE-2010-01-0711. (Presented as a technical keynote).

Singh J, Jugulum R, Soderborg N, Whitney DE, Frey DD. Streamlining robust parameter design efforts. J Des Res 2007; 5:435–448.

Singh J, Frey DD, Soderborg N. Noise strategy in robust design: What aspects of noise factors are important in quality engineering? Qual Eng 2006; 18:367–377.

Singh J, Frey DD, Soderborg N, Jugulum R. Compound noise: Evaluation as a robust design method. Qual Reliab Eng Int 2007; 23:387–398.

Soderborg N. Challenges and approaches to design for six sigma in the automotive industry. SAE World Congress 2005; SAE-2005-01-1211.

Thomas R, Soderborg N, Borders S. Using CAE to find and avoid failure modes: A steering wheel "nibble" case study. SAE World Congress 2005; SAE-2005-01-1399.

Farooq I, Pinkerton J, Abramczyk J, Barnes E, Culbertson P, Gearhart C, Pan L, Soderborg N, Yang H, Weishaar J. Model of IIHS side impact torso response measures using transfer function equations. SAE World Congress 2005; SAE-2005-01-0291.

Soderborg N. Design for six sigma at Ford. Six Sigma Forum Mag Nov 2004; 15–22.

Soderborg N, Crawley EF, Dori D. System function and architecture: OPM-based definitions and operational templates. Communications of the ACM 2003; 46:67–72.

Soderborg N. Representing systems through object-process methodology and axiomatic design. Master's Thesis, Massachusetts Institute of Technology, 2002.

Soderborg N. A characterization of domains quasiconformally equivalent to the unit ball. Michigan Math J 1994; 41:363–370.

Soderborg N. An ideal boundary for domains in n-space. Ann Acad Sci Fenn (Annals of the Finnish Science Academy) Series A. I. Mathematica 1994; 19:147–165.

Soderborg N. Quasiregular mappings with finite multiplicity and Royden algebras. Indiana University J Math 1991; 40:1143–1167.

Soderborg N. Quasiregular mappings and Royden algebras. Ph.D. Thesis, University of Michigan, 1991.

Presentations

Soderborg N, Huang S, Pearce H, Balavich K, Lange R. An estimate of side impact air bag effectiveness in fatality reduction. SAE 2010 Government/Industry Meeting, Washington, D.C., January 26–29, 2010.

Pearce H, Soderborg N, Balavich K, Lange R. Injury control technology insertion patterns during 1998 to 2000. SAE 2010 Government/Industry Meeting, Washington, D.C., January 26–29, 2010.

Soderborg N. What six sigma can teach us about improving reliability engineering. 14th Annual International Conference on Industrial Engineering Theory, Applications & Practice, Anaheim, CA, October 18–21, 2009.

Soderborg N. Design and analysis of computer experiments. Workshop, WCBF 4th Annual Design for Six Sigma Conference, Las Vegas, NV, February 9–11, 2009.

Soderborg N. Lean product development. WCBF 4th Annual Design for Six Sigma Conference, Las Vegas, NV, February 9–11, 2009.

Soderborg N. Implementing structures and processes for lean six sigma in product development. WCBF Global Lean, Six Sigma and Business Improvement Summit, Orlando, FL, October 15, 2008.

Soderborg N. DFSS in product development: Does one size fit all? American Society for Quality section meeting, Ann Arbor, MI, November 5, 2007.

Soderborg N. Measuring the financial and non-financial benefits of DFSS. WCBF Global Six Sigma Summit, Las Vegas, NV, October 25, 2007.

Soderborg N. Design and analysis of computer experiments: DFSS applications at Ford. Ford Computer-Aided Optimization and Robustness Conference, Dearborn, MI, September 27, 2007.

Soderborg N. Transfer functions: Where do they come from? Marcus Evans 4th Annual Design for Lean Six Sigma Conference, New Orleans, LA, January 15-17, 2007.

Soderborg N. DFSS in product development: Does one size fit all? WCBF 2nd Annual Design for Six Sigma Conference, Las Vegas, NV, September 13–14, 2006.

Soderborg N. DFSS tools for failure mode avoidance. Marcus Evans Design for Six Sigma Conference, Memphis, TN, January 17–18, 2006.

Singh J, Frey DD, Soderborg N. Evaluating compound noise as a method to improve robustness. ASME International Design Engineering Technical Conference & Computers and Information in Engineering Conference, IDETC2005-84828, Long Beach, CA, September 24–28, 2005.

Soderborg N. Using design for six sigma to drive scientific and statistical engineering. John Deere 2005 Six Sigma Conference: Driving Results with Six Sigma, Moline, IL, May 10, 2005.

Soderborg N. DFSS: The right tools at the right time. International Quality & Productivity Center Six Sigma Summit, Miami, FL, January 27–28, 2004.

Soderborg N. Integrating design for six sigma with your six sigma initiative. International Quality & Productivity Center Six Sigma Summit, Miami, FL, January 21–22, 2003.

Soderborg N, Crawley EF, Dori D. System definition for axiomatic design aided by object-process methodology. 2nd International Conference on Axiomatic Design, Cambridge, MA, June 10–11, 2002.

Lee J, Li D, Liu X, Sudjianto A, Vora M, Wang, S, Soderborg N. An approach to robust design employing computer experiments. 27th Design Automation Conference—ASME Design Engineering Technical Conferences, Pittsburgh, PA, September 9–12, 2001.

Liu X, Soderborg N. Improving an existing design based on axiomatic design principles. 1st International Conference on Axiomatic Design, Cambridge, MA, June 21–23, 2000.

Li D, Liu X, Sudjianto A, Vora M, Wang S, Soderborg N. An approach for computer experiment based robust design. 5th Society of Science and Applied Technology International Conference on Reliability & Quality in Design, Las Vegas, NV, August 11–13, 1999.

Soderborg N. Applications and challenges in probabilistic and robust design based on computer modeling. Spring Research Conference on Statistics in Industry and Technology, Minneapolis, MN, June 2, 1999.

Soderborg N, James J, Marko K. The geometric moving average in OBD-II misfire detection. On-Board Diagnostic Technologies section, SAE International Congress and Exposition, Detroit, MI, February 28, 1994.

Soderborg, N. A characterization of domains quasiconformally equivalent to the unit ball. American Mathematical Society/Mathematical Association of America Winter Meeting, Cincinnati, OH, January 15, 1994.

Marko K, Bryant B, Soderborg N. Process control and diagnostics: An evolutionary approach based on adaptive learning. U.S.-Korea Vibration Engineering Conference, Korea Advanced Institute of Technology, March 1993.

Marko K, Bryant B, Soderborg N. Neural network application to comprehensive engine diagnostics. IEEE International Conference on Systems, Man, and Cybernetics, Chicago, IL, October 1992.

Prior Experience

Six Sigma Master Black Belt and Supervisor, Ford Motor Company, 1994–2009
Chief Technical Officer, Nexus QPS, 2007–2009
Consultant, Decision Consultants, 1991–1994

Professional Affiliations

- American Society for Quality—ASQ (senior member)
- American Statistical Association
- Society for Industrial and Applied Mathematics—SIAM
- Society of Automotive Engineers—SAE