CURRICULUM VITAE

THE WILLIAM STATES LEE COLLEGE OF ENGINEERING

NAME: EDWARD MORSE DATE: SPRING, 2021

RANK OR TITLE: NORVIN KENNEDY DICKERSON JR. DISTINGUISHED PROFESSOR

DEPARTMENT: MECHANICAL ENGINEERING

OFFICE LOCATION: DUKE 108A

PHONE: 704-687-8342

EMAIL: EMORSE@UNCC.EDU

DATE OF FIRST EMPLOYMENT IN COE: NOVEMBER, 1999

DATE OF TENURE: 2005

EDUCATION

Degrees

Ph.D., Cornell University, Ithaca, NY, January 2000, Mechanical Engineering

M.S., Cornell University, Ithaca, NY, May 1997, Mechanical Engineering

Master of Engineering, Cornell University, Ithaca, NY, May 1989, Mechanical Engineering

Bachelor of Science, Swarthmore College, Swarthmore, PA, June 1985, Engineering

Certificates and Licenses

Certified Geometric Dimensioning and Tolerancing Professional – Senior Level (certificate S-0283, expires 3/17/2023)
certificate issued by ASME

EXPERIENCE

Academic

University of North Carolina at Charlotte	Nov. 1999 - present
Visiting Assistant Professor	Nov. 1999 - Dec. 1999
Assistant Professor	Jan. 2000 - 2005
Associate Professor	2005 – 2011
Professor	2011 – present
Distinguished Professor	beginning April 2021
Director, Center for Precision Metrology	beginning January 2021
Cornell University (graduate student)	Aug. 1993 - Oct. 1999
National Research Council / DOE Predoctoral Research Fellow	1995-99
Research Assistant	1993-94 and 1997-98
Teaching Assistant	1994-95
Laboratory Instructor	Fall 1996, Spring 1998

Industry Positions

National Institute of Standards and Technology July 2007 – June 2008

Visiting Scientist – Large Scale Metrology Group

Brown & Sharpe Mfg. Co., North Kingstown, RI 1989 - 1993

Applications Engineer - Measuring Systems 1989 - 1990

Design Engineer - Advanced Systems Group 1990 – 1993

Consulting

American Association for Laboratory Accreditation (A2LA), Technical and Lead Assessor, working with accrediting agency for determining compliance with ISO 17025 for dimensional calibration and inspection laboratories. June 2011 – present

Standards Council of Canada (SCC), Technical Assessor, working with accrediting agency for determining compliance with ISO 17025 (formerly 'Guide 25') for dimensional inspection laboratories in Canada. January 2001 – 2014

National Institute of Standards and Technology (NIST), Technical Consultant, working in the development of National Standards for coordinate measuring machines (support of standards group B89.4). 2004 – 2005

Weinstein Tippetts & Little LLP, Expert witness for case involving the interpretation of engineering drawings. 2015 – 2016

TEACHING ACCOMPLISHMENTS (academic and extension teaching)

Courses Taught

Title	*Course number*	*Dates*
Dynamic Systems I	MEGR3121	Spring 2000, Fall 2000, 2001, 2002, 2003, Spring 2005, Fall 2009, 2010, 2012, 2013, 2014, Spring 2015, Fall 2015, 2016, 2017, 2018
Statistical Process Control and Metrology	MEGR3282	Spring 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, Spring & Fall 2018, 2019, 2020, 2021
Motorsports Instrumentation	MEGR3090	Spring 2001 (co taught with Cuttino and Hill)
Geometric Dimensioning and Tolerancing	MEGR3090	Fall 2008
Precision Engineering & Metrology	MEGR3090	Spring 2015, 2016, 2017, 2018, 2019 (co taught with Evans)
Computational Methods	MEGR2240	Spring 2006, Fall 2006, Spring 2011, Fall 2011, Fall 2020
Theory and Application of Computer-Aided Tolerancing	MEGR7281/8281	Fall 2000, taught 2nd half of semester
Engineering Metrology	MEGR6181/8181	Fall 2006, 2008, 2009, 2010
Advanced Coordinate Metrology	MEGR7283/8283	Fall 2000 (co taught with Hocken), Fall 2001, 2002, 2003, 2004, 2015, 2017, 2019, Spring 2021
Data Analysis & Uncertainty	MEGR7090/8090 OPTI 6000/8000	Fall 2015, Fall 2017

Courses Developed (title, number)

MEGR2240 – Numerical Methods for Engineers (Spring 2006)

MEGR3090 – Special Topics: Geometric Dimensioning and Tolerancing (Fall 2008)

MEGR3090 – Special Topics: Precision Engineering and Metrology (Spring 2015, with C. Evans)

MEGR3090 – Special Topics: Motorsports Instrumentation (Spring 2001, with J. Hill and J. Cuttino)

MEGR7283/8283 – Advanced Coordinate Metrology (Fall 2000, with R. Hocken)

MEGR7090/8090 – Data Analysis and Uncertainty (Fall 2015, with C. Evans)

STUDENTS ADVISED

Undergraduate Students

I advised approximately 20 undergraduates per year before advising was taken over by the department in 2006.
I have served as advisor for five students in our department-sponsored REU program, one McNair undergraduate researcher, and one student in the honors program.
I serve as advisor/mentor/grader for senior design projects.

Graduate Students (student name, degree, and date)

Zhihua Zou	Ph.D.	May 2003
Terence Fagan	Ph.D.	May 2005
Xiaobin You	Ph.D.	December 2008
Samira Khanam	Ph.D.	December 2009
Jonathan Beaman	Ph.D.	August 2011
Mario Valdez	Ph.D.	December 2015
Saeed Heysiattalab	Ph.D.	August 2017
Farid Javidpour	Ph.D.	May 2019
Prashanth Jaganmohan	Ph.D.	December 2020
Jayaganesh Udayasankaran	M.S.	May 2002
John Nettles	M.S.	May 2004
Kalyana Bhamidi	M.S.	May 2005
Graham Averitt	M.S.	December 2005
Krishnakumar Gopal	M.S.	May 2006
Soumajit Dutta	M.S.	August 2008
Parikshit Kulkarni	M.S.	December 2012
Raunak Jadhav	M.S.	May 2014
Victoria Welty	M.S.	May 2015
Yue Peng	M.S.	May 2015
Prashanth Jaganmohan	M.S.	May 2017
Wenjun Kang	M.S.	August 2017
Corbin Grohol	M.S.	December 2018
Robert Turnbull	M.S.	May 2020
Attilio (A.J.) Mennuti	M.S.	May 2020

I have also served on the committees of numerous M.S. and Ph.D. students with my colleagues in ME&ES

External (International) Graduate Committee participation (student name, institution, and date)

Lars Krogstie	NTNU Trondheim (Norway)	Jan 2015
Nikolas Alexander Theissen	KTH Stockholm (Sweden)	Dec 2019
Bart Boeckmans	KU Leuven (Belgium)	March 2020

Current graduate students (degree, years completed, expected graduation)

Pooya Sharifani	Ph.D.	1.0 yr	May 2022
Laura Hopper	Ph.D.	1.0 yr	May 2022

Also two "early-entry" MS students, and an undergraduate researcher

RESEARCH ACCOMPLISHMENTS

Highlights

KEYNOTE PRESENTATIONS

A Brief Analysis of Recent ISO Tolerancing Standards and Their Potential Impact on Digitization of Manufacturing – Presented at CIRP CAT 2018, Milan ITALY
Co-authors: Shakarji, Srinivasan

Tolerancing: Managing uncertainty from conceptual design to final product – Presented at the CIRP General Assembly (STC Dn) 2018, Tokyo JAPAN
Co-authors: Dantan, Anwer, Söderberg, Moroni, Qureshi, Jiang, Mathieu

Recent activities, and the evolution of CMS standards in ISO TC 213 / WG10 – Presented at the 13th Coordinate Measuring Technique Conference 2018 in Szczyrk, POLAND

Interoperability: linking design and tolerancing with metrology – Presented at CIRP CAT 2016, Gothenberg, SWEDEN
Co-authors: Heysiattalab, Barnard-Feeney, Hedberg

Forging the Future of Large Scale Manufacturing – Presented at CMSC 2016, Murfreesboro, TN

The Interaction of Population Specifications with Statistical Specifications on Individual Features – Presented at CIRP CAT 2014, Hangzhou, CHINA

GD&T – Friend or Foe? – Presented at Quality Measurement Conference 2010, Orlando FL

STANDARDS WORK

Technical project leader for the publication of the following widely-used standards:

ISO 10360-10:2016 *Geometrical product specifications (GPS) — Acceptance and reverification tests for coordinate measuring systems (CMS) — Part 10: Laser trackers for measuring point-to-point distances*

ISO 10360-12:2016 *Geometrical product specifications (GPS) — Acceptance and reverification tests for coordinate measuring systems (CMS) — Part 12:Articulated arm coordinate measurement machines (CMM)*

Active project team member for the following fundamental ISO standards

ISO 1:2016 *Geometrical product specifications (GPS) — Standard reference temperature for the specification of geometrical and dimensional properties*

ISO 14253-1:207 *Geometrical product specifications (GPS) — Inspection by measurement of workpieces and measuring equipment — Part 1: Decision rules for verifying conformity or nonconformity with specifications*

Chair of ASME committee B89 Standards Committee – Dimensional Metrology (2019 – present)

Chair of ASME Subcommittee 4 – Coordinate Measuring Technology (2016 – present)

Ex-officio member of ASME's Board on Standardization and Testing (2019 – present)

CONSORTIUM BUILDING

PrecisionPath Consortium

Lead PI and founding board member of the PrecisionPath Consortium for Large-scale Precision Manufacturing Innovation. Initial funding by NIST, now a part of the Coordinate Metrology Society.

Center for Precision Metrology

I have been a researcher in this industry-focused center since I joined UNC Charlotte in 1999, and served as the deputy director from 2011-2020. As of January 2021 I have taken the role of center director.

Publications

Peer Reviewed Journals (i.e. books, book chaps, journals, proc., etc.; provide complete citations)

Morse, E. and Jaganmohan, P., (2020). 6 DOF calibration of profile sensor locations in an inspection station. *CIRP Annals, 69(1)*, pp.465-468.

Morse, E. and Grohol, C., (2019). Practical conformance evaluation in the measurement of flexible parts. *CIRP Annals, 68(1)*, pp.507-510.

Valdez, M. O., Morse, E. P., & Stroup, C. G. (2018). Measurement Uncertainty in Manufacturing Metrology: Uncertainty Analysis on the Measurement of Single-Fiber, PC Endface Fiber-Optic Connectors. *NCSLI Measure*, 12(2), 45-58.

Morse, E., Dantan, J.Y., Anwer, N., Söderberg, R., Moroni, G., Qureshi, A., Jiang, X. and Mathieu, L., (2018). Tolerancing: Managing uncertainty from conceptual design to final product. *CIRP Annals, 67(2)*, pp.695-717.

Valdez, M. O., & Morse, E. P. (2017). The role of extrinsic factors in industrial task-specific uncertainty. *Precision Engineering*, 49, 78-84.

Schmitt, R. H., Peterek, M., Morse, E., Knapp, W., Galetto, M., Härtig, F., ... & Estler, W. T. (2016). Advances in large-scale metrology–review and future trends. *CIRP Annals*, 65(2), 643-665.

Phillips, S. D., Shakarji, C. M., Balsamo, A., Krystek, M., & Morse, E. P. (2016). The 2016 Revision of ISO 1–Standard Reference Temperature for the Specification of Geometrical and Dimensional Properties. *Journal of Research of the National Institute of Standards and Technology*, 121, 498-504.

Morse E, Welty V., "Dynamic testing of laser trackers", *CIRP Ann - Manuf Technol.* 2015; 64(1):475-478.

Dong, Y., Hutchens, T., Mullany, B., Morse, E., Davies, A., "Using a three-dimensional optical simulation to investigate uncertainty in image-based dimensional measurements," *Optical Engineering*, v 53, n 9, September 2014

Morse, E., Peng, Y., Srinivasan, V., Shakarji, C., "Metrological challenges introduced by new tolerancing standards", *Measurement Science and Technology*, v 25, n 6, June 2014

Zheng, B., Dong, Y., Mullany, B., Morse, E., Davies, A., "Positioning sensor by combining photogrammetry, optical projection and a virtual camera model", *Measurement Science and Technology*, v 24, n 10, October 2013.

Morse, E. and Srinivasan, V., "Size tolerancing revisited: A basic notion and its evolution in standards," *Proc IMechE Part B: J Engineering Manufacture*, 227(5) pp. 662–671, April 2013.

Zheng, B., Dong, Y., Davies, A., Mullany, B., and Morse, E., "Using Optical Projection in Close-range Photogrammetry for 6DOF Sensor Positioning", *Photogrammetric Engineering & Remote Sensing*, vol. 79, no 1, pp. 79-86, January 2013.

Srinivasan, V., Shakarji, C. M., and Morse, E.P., "On the Enduring Appeal of Least-squares Fitting in Computational Coordinate Metrology", *ASME J. Comput. Inf. Sci. Eng.*, 2012;**12(1)**

Salsbury, J.G., Morse, E.P., "Measurement uncertainty in the performance verification of indicating measuring instruments," *Precision Eng*, (2011), doi:10.1016/j.precisioneng.2011.10.001

Muralikrishnan, B., Sawyer, D., Blackburn, C., Phillips, S., Shakarji, C., Morse, E., and Bridges, R., "Choosing Test Positions for Laser Tracker Evaluation and Future Standards Development", *Journal of the CMSC*, Vol. 6, No. 1, Spring 2011.

Miller, J., Dutta, S., Morse, E., and Yague-Fabra J., "Stylus diameter determination using near zero-width reference", *Precision Engineering*, v 35, n 3, p 500-504, July 2011.

Morse, E. P., "*Basic CMM operation*" and "*Design Intent: Geometric Dimensioning and Tolerancing*", in **Coordinate Measuring Machines**, 2nd Edition, Pereira and Hocken, Eds, CRC Press, 2011.

Morse, E.P. and You, X., GapSpace Multi-dimensional Assembly Analysis, Chapter 15, in **Product Lifecycle Management: Geometric Variations**, Giordano, Mathieu, and Villeneuve, Eds., ISTE Ltd and John Wiley & Sons, pp. 273-298, 2010.

Peer Reviewed Journals – *continued*

Subramanian, K. and Morse, E.P., Assembly Analysis of Interference Fits in Elastic Materials, Chapter 2, section 2, in **Precision Assembly Technologies and Systems**, S. Ratchev, Ed., IFIP AICT 315, pp. 41-49, 2010.

Beaman, J. M. and Morse, E. P., "Experimental Evaluation of Software Estimates of Task Specific Measurement Uncertainty for CMMs", *Precision Engineering*, v. 34, no. 1, pp. 28-33, January 2010.

Beaman, J. M., Cuttino, J. F., and Morse, E. P., "Parameter Influence on Dimensional Variation in Green Sand Iron Castings", *Transactions of the American Foundry Society*, Vol 115, pp 349-356, 2007

Morse, E.P., and Farooqui, S. A., "Methods and Artifacts for Comparison of Scanning CMM Performance", *ASME J. Comput. Inf. Sci. Eng*., Vol 7/1, March 2007

Zou, Z., and Morse, E. P., "A gap-based approach to capture fitting conditions for mechanical assembly", *Computer-Aided Design*, Vol 36/8 pp 691-700, 2004.

Morse, E. P., and Zou, Z., "Applications of GapSpace model for multidimensional mechanical assemblies", *J. Comput. Inf. Sci. Eng.* Vol 3 pp 22-30, 2003.

Pasupathy, T. M., Morse, E. P., and Wilhelm, R. G., "A survey of mathematical models for the construction of geometric tolerance zones", *J. Comput. Inf. Sci. Eng.* Vol 3 pp 64-75, 2003.

Cuttino, J. F., Kachru, A., Morse, E. P., and Patterson, S. R., "A Parametric Study on the Effects of Four Casting Parameters on Dimensional Variation in Thin Castings", *Transactions of the American Foundry Society*, Vol. 110, pp 715-731, 2002.

Cuttino, J. F., Kachru, A., Morse, E. P., and Piwonka, T., "The Effects of Shot Blasting on Dimensional Variation of Castings", *Transactions of the American Foundry Society*, Vol. 110, pp 747 - 757, 2002.

Peer Reviewed Conference Papers (full length paper review)

Berglund, J., Söderberg, R., Wärmefjord, K., Leach, R. and Morse, E., (2020). Functional tolerancing of surface texture–a review of existing methods. *Procedia CIRP*, 92, pp.230-235.

Fischer, B. and Morse, E., (2020). Defining and Controlling Variation of Highly-Interrupted Collected Features. *Procedia CIRP*, 92, pp.158-162.

Morse, E., (2019). Design for Metrology–a new idea? *Procedia CIRP*, 84, pp.165-168.

Fischer, B. and Morse, E., (2019), Definition and Evaluation of Induced Geometry for Design. In *ASME International Mechanical Engineering Congress and Exposition* (Vol. 59384, p. V02BT02A058). American Society of Mechanical Engineers.

Morse, E.P., Shakarji, C.M. and Srinivasan, V., (2018). A Brief Analysis of Recent ISO Tolerancing Standards and Their Potential Impact on Digitization of Manufacturing. *Procedia CIRP*, 75, pp.11-18.

Morse, E., Heysiattalab, S., Barnard-Feeney, A., & Hedberg, T. (2016). Interoperability: linking design and tolerancing with metrology. *Procedia CIRP*, 43, 13-16.

Morse E., Srinivasan V., and Voelcker H., "Size tolerancing revisited: A basic notion and its evolution in standards", *12th International CIRP Seminar on Computer Aided Tolerancing*, University of Huddersfield, UK, April 18-19, 2012.

Morse, E., and You, X., "GapSpace Multi-dimensional Assembly Analysis", *11th International CIRP Seminar on Computer Aided Tolerancing*, Université de Savoie, Annecy, France, March 26-27, 2009.

Beaman, J., and Morse, E., "Experimental Evaluation of Software Estimates of Task Specific Measurement Uncertainty for CMMs", *10th International CIRP Seminar on Computer Aided Tolerancing*, Friedrich-Alexander University, Erlangen, Germany, March 21-23, 2007.

Morse, E., You, X. "Implementation of GapSpace Analysis", *2005 ASME International Mechanical Engineering Congress*, Orlando, FL, November 2005.

Subramanian, K., Morse, E., "Analysis of Interference Fits in Elastic Materials", *2005 ASME Design Engineering Technical Conferences* (Design for Manufacture and Life Cycle), Long Beach, CA, September 2005.

Morse, E. P., "Statistical Analysis of Assemblies having Dependent Fitting Conditions", *Proc. ASME International Mechanical Engineering Congress*, Anaheim, CA, November, 2004.

Morse, E., Gopal, K., Raja, J., "The Surface Wavelength Composition of Thin Wall Iron Castings, and its Influence on CMM Measurements", *Proc. ASME International Mechanical Engineering Congress*, Anaheim, CA, November, 2004.

Morse, E. P., "On the complexity of mechanical assembly", *Proc. DETC 2003, 8th Design for Manufacturing Conference*, Chicago, Illinois, September, 2003.

Zou, Z. and Morse, E. P., "Assembleability analysis using GapSpace model for 2D mechanical assembly", *Proc. DETC 2002, 7th Design for Manufacturing Conference*, Montreal, Canada, September, 2002.

Morse, E. P., "Capturing assembly tolerances and criteria in a common model", *Proc. DETC 2001, 27th Design Automation Conference*, Pittsburgh, PA, September, 2001.

Other (reports, papers and proceedings based on reviewed abstract, invited lectures)

Morse, E., "Recent activities, and the evolution of CMS standards in ISO TC 213 / WG10", ***Keynote*** presentation at the XIII International Scientific Conference Coordinate Measuring Technique, Szczyrk, Poland, 11-13 April 2018.

Morse, E., Heysiattalab, S., Barnard-Feeney, A., & Hedberg, T. (2016). Interoperability: linking design and tolerancing with metrology. ***Keynote*** presentation at the CIRP Computer-Aided Tolerancing Seminar, Gothenburg, Sweden. May 2016.

Heysiattalab, S., and Morse, E. (2016). From STEP to QIF: Product and Manufacturing Information. Proceedings of the 31st ASPE Annual Meeting, Portland, OR, October 2016, vol. 65.

Morse, E. P., "Forging the Future of Large Scale Manufacturing" – ***Keynote*** presentation at CMSC 2016, Murfreesboro, TN, July 2016.

Morse E,. "Tolerancing standards: a comparison", *Quality. 2016* Aug 1;55(8):40-4.

Morse, E., "Accreditation for Dimensional Testing with Coordinate Measuring Machines", Proc 2015 NCSL International Workshop and Symposium, July 21-23, 2015. Grapevine, TX.

Morse, E.P., "The Interaction of Population Specifications with Statistical Specifications on Individual Features", ***Keynote*** presentation at the CIRP Computer-Aided Tolerancing Seminar, Hangzhou, China. May 12-14, 2014

Morse, E., "Issues in the testing of Portable Coordinate Measuring Systems (CMS)", Proc 2014 NCSL International Workshop and Symposium, July 28-31, 2014. Orlando, FL.

Morse, E., "Interim testing strategies for Coordinate Measuring Machines", Proc. 2013 NCSL International Workshop and Symposium, July 14-18, 2013. Nashville, TN.

Jadhav, R., Morse, E., "Development of error budget software for machine tools", Proc. 28th Annual Meeting of the American Society for Precision Engineering, ASPE 2013, p 427-430, 2013.

Morse, E., "Uncertainty in Dimensional Testing of Workpieces", NCSLI Annual Meeting, July 28-Aug 3, 2012, Sacramento, CA

Morse, E., "The (continuing) evolution of Articulated Arm CMM testing", NCSL I Conference, Washington, DC, August 2011. *Best Paper in the Metrology Skills track.*

Dong, Y., Hutchens, T., Davies, A., Mullany, B., Morse, E., "Evaluating Error Sensitivity in Photogrammetry with 3D Optical Simulation Software", ASPRS Annual Meeting, Milwaukee, WI, May 2011.

Zheng, B., Mullany, B., Morse, E., Davies, A., "Sensing Position by Combining Photogrammetry and Optical Pattern Projection", ASPRS Annual Meeting, Milwaukee, WI, May 2011.

Bowes, K., Mullany, B., Morse, E., Davies, A., "Surface Form Measurements Combining Beam Propagation, Optical Scattering, and Photogrammetry", ASPE Spring Topical Meeting on Structured and Free-form Surfaces, Charlotte, NC, March 2011.

Morse, E.P., "New Standards for CMM testing", presented at Measurement Science Conference, Pasadena, CA, March, 2011.

Morse, E. P., "Appropriate Uncertainty Estimates for Instrument Testing", Proc. of the NCSL International Workshop and Symposium, Providence, RI, August, 2010.

Morse, E. P., *GD&T – Friend or Foe?*, invited Keynote Talk, Quality Measurement Conference, Marriott World Center, Orlando FL, March, 2010.

Morse, E. P., "Recent standards development for CMM performance evaluation", Proc. of the NCSL International Workshop and Symposium, San Antonio, TX, August, 2009.

Morse, E. P., "ISO Activity Related to GPS", invited seminar, University of Zaragoza, March 2010, Zaragoza, Spain.

Khanam, S. A., and Morse, E. P., Test Uncertainty Ratio (TUR), *Proc. of ASPE Spring Topical Meeting*, Albuquerque, NM, April 6-7, 2009

Morse, E. P., and Khanam, S. A., Test Uncertainty in ISO TC213, *Proc. of ASPE Spring Topical Meeting*, Albuquerque, NM, April 6-7, 2009

Shakarji, C., Morse, E., Rhoher, R., Phillips, S., Slotwinski, J., *USCAR Digital-Virtual-Tools Team - Modeling of Compliant Parts Project - Phase 2 Final Report*, NIST Report concluding collaboration between NIST and the United States Council for Automotive Research (USCAR), November 2008

Morse, E. P., "CMM Task-specific Measurement Uncertainty", *NSCLI 2008*, Orlando, FL, August 3-7, 2008

Morse, E. P., Work in the ASME B89.4.21 committee relating GD&T and CMM inspection, *ACMC 2008*, Ontario, Canada, June 26-27, 2008

Morse, E., "Metrology Education at UNC Charlotte", presented at *NCSLI 2007*, Saint Paul, MN, July 29-August 2, 2007

Morse, E., and Khanam, S., "The 4:1 Rule for CMM Measurements", presented at the *ACMC 2007*, Rochester, NY, June 21-22, 2007.

Morse, E., "CMM Calibration and the ISO Standards", presented at *NCSLI 2006*, Nashville, TN, August 6-10, 2006

Morse, E., "CMMs vs. GD&T: the ongoing battle", (invited paper), *Proceedings of the Manufacturing and Metrology Conference and Workshop*, Nashville, TN, April 2006.

Morse, E., "Research Activities in Metrology at UNC Charlotte", (invited paper), *Proceedings of the NCSLI Annual Conference*, Washington DC, October 2005.

Morse, E., Raffaldi, J., Schmidl, J., "Multisensor Measurement Platforms", (invited paper) *Proceedings of the International Dimensional Workshop*, Nashville, TN, April 2005.

Gopal, K., Morse, E., and Cuttino, J., "A Study of CMM Measurement Variation in Precise, Thin-wall Iron Castings", *Proc. 19th Annual Meeting of ASPE*, Orlando, FL, October 2004.

Morse, E., Farooqui, S., "Alternative Artifacts for Evaluating Scanning CMM performance – an update", *Proc. 19th Annual Meeting of ASPE*, Orlando, FL, October 2004.

Miller, J. , Morse, E., Nettles, J., and Turner, J., "Kite Square", *Proc. 19th Annual Meeting of ASPE*, Orlando, FL, October 2004.

Morse, E., Bhamidi, K., "Performance Testing of a Multi-Sensor CMM based on Single Artifact Measurements", *Proc. 19th Annual Meeting of ASPE*, Orlando, FL, October 2004.

Inampudi, K., Lawton, K., Cherukuri, H., and Morse, E., "Uncertainty in Soakout Time Estimation", *Proc. NCSL International Annual Conference*, Salt Lake City, UT, July 2004.

Morse, E., Bhamidi, K., "Investigations in Hybrid (multi-sensor) CMM errors based on artifact measurement", *Proc. NCSL International Annual Conference*, Salt Lake City, UT, July 2004.

Morse, E., "Testing Scanning CMMs - How much do the standard tests tell us?", *International Dimensional Workshop (IDW) 2004*, Nashville, TN, May 10-12, 2004.

Morse, E., Bhamidi, K., "Uncertainty of Measurements Using Multisensor CMMs", *Proc. 18th Annual Meeting of ASPE*, Portland, OR, October 2003.

Morse, E. Farooqui, S., "Alternative Artifacts for Evaluating Scanning CMM performance", *Proc. 18th Annual Meeting of ASPE*, Portland, OR, October 2003.

Cherukuri, H., Inampudi, K., Lawton, K., and Morse, E., "The Influence of Thermistors on Surface Temperature", *Proc. NCSL International Annual Conference*, Tampa, FL, August 2003.

Zou, Z. and Morse, E. P., "Tolerance analysis for a window frame: an underconstrained assembly", *Proc. 8th CIRP International Seminar on Computer-Aided Tolerancing*, pp. 114-123, UNC Charlotte, Charlotte, NC, USA, April 2003.

Morse, E. P., "Uncertainty Q&A", *mfg.* (a magazine distributed by the Brown & Sharpe Manufacturing Co.) Vol 10/1 pp 24-25, April 2003.

Zou, Z., Morse, E. P., "Finding the relative motion space of an assembly using the GapSpace model", *Proc. ASPE Summer Topical Meeting on Tolerance Modeling and Analysis*, Charlotte, NC, July 2002.

Morse, E. P., "Artifact selection and its role in CMM evaluation", *Proc. International Dimensional Workshop (IDW) 2003*, Knoxville, TN, May 2002.

Zou, Z. and Morse, E. P., "2D extension of the GapSpace model for Tolerance Analysis", *Proc. 16th Annual Meeting of ASPE*, Crystal City, MD, October 2001.

Wang, K., and Morse, E. P., "Correlation of Spindle Errors to Piece-Part Accuracy", *Proc. 16th Annual Meeting of ASPE*, Crystal City, MD, October 2001.

Morse, E. P., and Wang, K., "Using alternative artifacts for error motion analysis", *Proc. ASPE Summer Topical Meeting on Precision Bearings and Spindles*, pp. 100-103, State College, PA, June 2001.

Zou, Z. and Morse, E. P., "Statistical tolerance analysis using GapSpace", *Proc. 7th CIRP International Seminar on Computer-Aided Tolerancing*, pp. 313-322, ENS de Cachan, France, April 2001.

Morse, E. P., and Salsbury, J. G., "The interaction of measuring errors and workpiece errors in feature evaluation algorithms", *Proc. 15th Annual Meeting of ASPE*, pp. 485-488, Scottsdale, AZ, October 2000.

Morse, E. P., "Compensation of Probing Errors", *mfg.* (a magazine distributed by the Brown & Sharpe Manufacturing Co.), vol. 7, no. 2, June 2000.

Voelcker, H. B., and Morse, E. P., “Assessing Conformance to a Radius Tolerance”, *mfg.* (a magazine distributed by the Brown & Sharpe Manufacturing Co.), vol. 7, no. 1, April 2000.

Morse, E. P., "Distribution-free statistical methods for analyzing linear tolerance accumulation", *Proc. 13th Annual Meeting of ASPE*, pp. 562-566, St. Louis, Missouri, October, 1998.

Morse, E. P., "Short Communication: More on the effects of non-normal statistics in geometric tolerancing", **Geometric design tolerancing: theories, standards, and applications**, Ed. H. ElMaraghy, Chapman & Hall, London, 1998.

Voelcker, H. B., and Morse, E. P., “De-mystifying Cp and Cpk”, *mfg.* (a magazine distributed by the Brown & Sharpe Manufacturing Co.), vol. 4, no. 1, April 1997.

Braun, P. R., Morse, E. P., and Voelcker, H. B., "Research in statistical tolerancing: Examples of intrinsic non-normalities, and their effects", *Proc. 5th CIRP Seminar on Computer Aided Tolerancing*, Ed. H. ElMaraghy, pp. 1-12; University of Toronto, Toronto, Canada, April 1997.

Morse, E. P., and Voelcker, H. B., “A tale of two tails”, *mfg.* (a magazine distributed by the Brown & Sharpe Manufacturing Co.), vol. 3, no. 1, April 1996.

Presentations and Other Research Activities

CMSC annual conference, presentation on "QIF 2.0: supporting the Metrology life-cycle", Hollywood Beach, FL, July 2015

Cummins Science and Technology Council meeting, invited presentation on "Advanced metrology tools and their implementation", Columbus, IN, July 2013.

"The Language of Uncertainty and its use in the ASME B89.7 Standards" (presentation only), ASME 2013 Verification & Validation Symposium, May 22-24, 2013, Las Vegas, NV.

Cummins Worldwide Metrology Council Meeting, invited presentation on "CMM Technology and Standards", Columbus, IN, July 2008.

"CMMs: From Construction and Control to Strategies and Performance", Tutorial at QMC 2008, Clearwater Beach, Florida, April 28th-May 1st, 2008.

"Stackup of Tolerances, and Statistics Thereof", invited presentation at the INTEL corporation, Chandler, AZ, May 16, 2006.

Cummins Worldwide Metrology Council Meeting, invited presentation on "Current State of Metrology Technology", Columbus, IN, May 2006.

"A Proposal for New Work Items for WG 10", presented at the September 2005 meeting of the International Organization of Standards in Tsukuba, Japan for Technical Committee 213, WG 10.

Professional Meeting Papers, Workshops (provide date, location, session chair, session organizer, etc.)

E. Morse, P. Jaganmohan, "Capturing Measurement Resources in the QIF Format", QIF Summit, Golden, CO, October 2-6, 2017

Heysiattalab, S., Morse, E., "QIF Measurement Resources Working Group Report", QIF Summit, Arlington, TX, October 5-9, 2015.

Morse, E., "Evaluating CMM Probes, Probe Heads, and Styli", (invited talk), 2014 NACMA Workshop, Toronto, ON, CANADA, September 23-26, 2014.

Morse, E., "Interim testing strategies for Coordinate Measuring Machines", (invited talk), 2014 NACMA Workshop, Toronto, ON, CANADA, September 23-26, 2014.

Morse, E., "Evaluating CMM Probes, Probe Heads, and Styli", (invited talk), 2013 NACMA Workshop, Gaithersburg, MD, August 27-30, 2013.

Morse, E., "Geometric Tolerancing and Coordinate Metrology", (invited talk), 2010 NACMA Workshop, Minneapolis, MN, August 2010.

Morse, E., " Specification, Analysis, and Measurement of Geometric Variability for Discrete Parts Manufacturing", NSF Grantees Conference, Honolulu, HI, June 21-24, 2009.

Khanam, S. A. and Morse, E. P., "Test Uncertainty / TUR", (poster), ASPE Annual Meeting, Portland, OR, October 19-24, 2008

"Standardization on Testing of LaserTrackers", 3rd International Workshop on Traceability in Large Scale Metrology, Braunschweig, Germany, November 14-15, 2006.

Morse, E., "CAREER: Geometric Variability in Engineering Design" (Poster), NSF Grantees Conference, St. Louis, MO, July 24-27, 2006.

Morse, E., "Tolerances that you can't inspect: GD&T interpretation by people and software", (invited talk), 2006 ACMC Workshop, Ottawa, Canada, June 2006.

"Coordinate Measuring Machines", Tutorial at the ASPE 2005 Annual Meeting, Norfolk, VA.

Morse, E., "CAREER: Geometric Variability in Engineering Design: Education, Research and Outreach Activities" (poster only), NSF Career Mentoring Conference, Arlington, VA, January 2004.

Morse, E., "Geometric Tolerancing and Metrology in the Undergraduate Curriculum", NSF Design and Service Research Conference, Dallas, TX, January 2004.

Morse, E., "The Complexity of 'Floating' Assemblies" (presentation only), CIRP 8th International Workshop on Computer-Aided Tolerancing, Charlotte, NC, April 2003.

Professional Meeting Papers, Workshops – *continued*

Morse, E., "Experimental Measurements of Uncertainty using a Multi-Sensor (hybrid) Coordinate Measuring Machine" (presentation only), International Dimensional Workshop (IDW) 2003, Nashville, TN, May 2003.

Patents (provide title/description, patent number and date or pending)

Invention Report: Specification and Analysis of Geometric Variability in Engineering Design. Invention Report No. 2003-029. Edward P. Morse. June 2003.

US PATENT 9,151,607 B2: **Dimensional measurement through a combination of photogrammetry and optical scattering**; Angela Davies; Brigid Mullany; Edward Morse; and Matthew Davies; assigned to UNIVERSITY OF NORTH CAROLINA AT CHARLOTTE, Charlotte, NC (US).

Grants and Contracts Awarded: (provide principal and co-investigators, title, sponsor, funding dates, amount)

"Non-contact dimensional inspection - Defect detection", funded by Honeywell Inc., $123,600, January 2021 – August 2021.

"Enhanced Optical Measurement Technologies", funded by Honeywell Inc., $324,789, January 2020 – August 2020.

"Error Sources in XCT Systems", (PI: Edward Morse), funded by NIST, $52,134, August 2019 – August 2020.

"SBIR: Advanced nanometer coordinate metrology for freeform and large optics", (PI: Chris Evans, Co-PI: Edward Morse), NASA funding subcontracted from OptiPro Systems, $31,000, September 2019 – June 2020.

"SBIR: Chromatic Interferometric Probe", (PI: Chris Evans, Co-PI: Edward Morse), NASA funding subcontracted from OptiPro Systems, $25,000, September 2019 – June 2020.

"Generation of 3D point clouds from multiple line-data sensors", (PI: Edward Morse), $79,861, funded by +Vantage Corporation, $79,861, December 2018 – April 2020.

"Non-contact Dimensional Inspection – Phase 3", (PI: Edward Morse), $161,624, January 2019 – August 2019.

"North Carolina Consortium for Self-Aware Machining and Metrology (CSAM)", (PI: Tony Schmitz, many Co-PIs) $1,665,532 – July 2018 – June 2022.

"Application of the Digital Twin Model for Repair Processses", (PI: Joshua Tarbutton, Co-PI: Edward Morse), $120,000 (two phases), July 2018 – June 2020.

"Non-contact Dimensional Inspection – Phase 2", (PI: Edward Morse), $166,783, January 2019 – August 2019.

"Investigation of non-contact Profile measurement", (PI: Edward Morse), funded by Honeywell, Inc. - $62,567, July 11 – September 22, 2017.

"Consortium for Large-scale Precision Manufacturing Innovation", (*Lead PI:* Edward Morse, PIs: John Ziegert, Ram Kumar, Antonis Stylianou, Ron Hicks), funded by NIST – $486,300. Start Date: June 1, 2015.

"Democratizing the Model-based Domain from Design to Verification: Automatic Generation of Optimized CMM Programs on the DMC", (PI: Edward Morse), funded by MetroSage, LLC – $27,883, October 2016 – March 2018.

"Demonstration of a Closed-loop Digitally Enabled Manufacturing Process using Advanced Metrology Techniques", (PI: John Ziegert, Co-PI: Edward Morse), funded by Siemens Energy – $133,222, August 2016 – January 2018.

"Improved Methods for Mounting and Alignment of Rotors on Slotter", (PI: John Ziegert, co-PI Edward Morse), funded by Siemens Energy, $55,071 for this extension. Start Date: January 1, 2015.

"Tolerancing Standards and Associated Modeling Challenges", (PI: Edward Morse), funded by NIST – $340,096. Start Date: October 1, 2014

Grants and Contracts Awarded: *– continued*

"Measurement Uncertainty in Manufacturing Metrology - Data Pixel case study", (PI: Edward Morse), funded by Corning Optical Communications, LLC, $11,399. Start Date: April 1, 2014.

"In-Situ measurement of blade tips for tip grinding", (PI: Edward Morse), funded by Siemens Energy, $54,554. Start Date: August 30, 2013.

"Measurement and Reporting of Muffler IDs", (PI: Edward Morse, co-PI Chris Evans), funded by Siemens Energy, $65,664. Start Date: August 30, 2013.

"Measurement of Throttle Valves & Components Based on Laser Trackers", (PI: Edward Morse), funded by Siemens Energy, $51,204. Start Date: August 15, 2012.

"Support of Standards for Geometric Product Specification and Verification", (PI: Edward Morse), funded by NIST – $283,896. Start Date: October 1, 2011.

In Situ Form Metrology in Manufacturing by Combining Engineered Optical Scattering and Photogrammetry, (PI's: Angela Davies, Edward Morse, and Brigid Mullany), funded by NSF – $464,062. Start Date: August 1, 2009.

Advancement of US National Standards for Coordinate Measuring Machines and their sub-systems, PI: Edward Morse, funded by NIST/Department of Commerce – $42,382. Start Date: June 15, 2009.

Estimation of Uncertainty for Machine Tools using Software Simulation, PI: Edward Morse, funded by Sandia National Labs – $15,000. Start Date, August 2008.

Research in the Uncertainty of Dimensional Measurements, PI: Edward Morse, funded by NIST/Department of Commerce, for support during leave of absence from UNC Charlotte – $94,950. Start Date: July 1, 2007.

Test Uncertainty and TUR, PI:, E. Morse, funded by the NSF I/UCRC Center for Precision Metrology affiliates program – approx. $89,000

Metrology Software: I++ for Machine Control, PI's:, A. Davies and E. Morse, funded by the NSF I/UCRC Center for Precision Metrology affiliates program – approx. $65,000

Evaluation and Verification of CMM Task-specific Measurement Uncertainty Tools, PI: Edward Morse, funded by BWXT–Y12 National Security Complex through the Plant-directed R&D (PDRD) program (this is a subcontract to a DOE prime contract with BWXT) – $161,019. Start Date: April, 2005.

Estimation and Validation of CMM Task-Specific Measurement Uncertainty Using a Hole-Plate Artifact, PI: Edward Morse, funded by BWXT–Y12 National Security Complex through the Plant-directed R&D (PDRD) program (this is a subcontract to a DOE prime contract with BWXT) – $89,606. Start Date: February, 2004.

Industry/University Cooperative Research Center for Precision Metrology, (PI: R. Hocken, Co-PIs: A. Davies, E. Morse, R. Wilhelm) – Funded by the NSF $215,000. Start date: 1 August, 2003.

NSF CAREER: Specification and Analysis of Geometric Variability in Engineering Design, PI: Edward Morse, funded by NSF – $400,000. Start Date: 15 February, 2003.

Determination of Bulk Dimensional Variation in Castings, (PIs: J. Cuttino, E. Morse, and T. Piwonka) – Funded by the DOE $408,883 with $405,000 in industrial matching support. Start date: 15 September, 2001.

Precision Engineering Research Support, (PI: Edward Morse), funded by OpSource, Inc., $4597.

Support of Research Work in Computational Modeling and Analysis, (PI: Edward Morse), funded by MEAS, Inc. – $5000

Thermal Effects in Metrology, PI's: H. Cherukuri, E. Morse, funded by the NSF I/UCRC Center for Precision Metrology affiliates program – approx. $65,000

Research in Interference Assembly, PI: Edward Morse, funded by a UNC-Charlotte Junior Faculty Grant, $5865

Correlation of Spindle Errors to Piece-part Accuracy, PI: E. Morse, funded by the NSF I/UCRC Center for Precision Metrology affiliates program – approx. $44,000

Grants and Contracts Awarded: *– continued*

Hybrid CMMs, PI: E. Morse, funded by the NSF I/UCRC Center for Precision Metrology affiliates program – approx. $48,000

SERVICE

Major Committee Assignments (professional, university, college, and departmental and dates)

PROFESSIONAL SERVICE

Chairman, Carolinas Section of SAE	June 2008 – June 2010
Member, National Sections Board, SAE	May 2008 – 2011
Board Member, Carolinas Section of SAE	2002 – 2016
Chairman, Design for Manufacturing Technical Committee, in the Design Engineering Division of ASME	July 2008 – June 2009

UNIVERSITY SERVICE

GPD Advisory Council	(Fall 2013 – Fall 2015
Academic Integrity Board	(Aug. 2011 – Aug. 2014)
Faculty ITS Advisory Council	(Aug. 2010 – May 2012, Fall 2016 – present)
Faculty Council	(Aug. 2010 – July 2012)
Faculty Council – alternate	(Sept. 2008 – May 2009)
Faculty Competitive Grants Committee	(May 2002 – April 2004)

COLLEGE OF ENGINEERING SERVICE

Search Committee – Chair of Systems Engineering (Fall 2015)

SPART – Strategic Planning and Assessment Resource Team (Sept. 2003 – 2011)

College of Engineering Reappointment, Promotion, and Tenure Committee (Sept. 2006 – March 2007)

College of Engineering Academic Policy and Curriculum Committee (Sept. 2004 – May 2006)

Engineering Management faculty search committee (March 2000)

DEPARTMENT OF ME&ES SERVICE

Associate Chair for Graduate Programs (September 2011 – December 2014)

Department promotion and tenure review committee (2012–2013, 2015–2016)

ABET Development & Preparation leader (September 2003 – May 2011)

Focus-area Improvement Team leader – Dynamics (Sept. 2003 – Sept. 2011)

Library Representative (2000 – 2006)

Motorsports Lecturer Search Committee (September 2004)

Computational Mechanics faculty search committee (October 2001 – April 2002)

Motorsports faculty search committee (October 2000 – May 2001)

Motorsports Strategic Planning Committee (September 2000 – April 2001)

Department promotion and tenure review committee [non-voting] (2000 – 2001)

Professional and Scholarly Organizations (including memberships, committee assignments, conference planning, editorial services, offices held and dates)

EDITORIAL SERVICES

Guest Editor, **Procedia CIRP** (92) Special Issue - *16th CIRP Conference on Computer Aided Tolerancing (CIRP CAT 2020)*

Associate Editor, **Precision Engineering** April 2008 – 2014

Journal article reviewer for *Precision Engineering*, *ASME Journal of Mechanical Design*, *ASME Journal of Manufacturing Science and Engineering*, *ASME Journal of CISE*, *International Journal of Machine tools and Manufacture*, *International Journal of Advanced Manufacturing Technology*, *IEEE Transactions on Robotics and Automation*

Conference Paper Reviewer for *ASME Design Engineering Technical Conferences*, *IMECE (ASME Congress)*, *IEEE International Symposium on Assembly and Task Planning*, *The International Conference on Product Lifecycle Management*, *The CIRP International Seminar on Computer Aided Tolerancing*

Reviewer of Abstracts for the *ASPE Annual Meetings, NAMRC*

AMERICAN NATIONAL STANDARDS SERVICE ACTIVITY

Participant in ASME standards committees:

Board on Standardization and Testing (ex-officio member)
B89 Dimensional Metrology – main committee (Chair)
B89.3.4 Axes of Rotation (member)
B89.7 Measurement Uncertainty (member)
B89.4 Coordinate Measuring Technology (Division Chair)
project team 4.11 Probes and Probe Changers (Team Chair)
project team 4.20 Software testing (member)
project team 4.21 Real environments (member, task force leader)
Y14.5.1 Mathematical Definition of Y14.5 (member)
TAG213 US TAG to ISO TC213 (vice-chair)

Participant in ASTM standards committee:

E57.02 3D Imaging Systems- medium range (member 2008-2010)

INTERNATIONAL STANDARDS SERVICE ACTIVITY

Participant in ISO standards committees:

TC213 – Geometrical Product Specification		committee member
advisory group 12	Mathematical Support Group for GPS	(SME1*)
working group 4	Uncertainty	(SME2)
working group 10	Coordinate Measuring Machines	(SME2)
Laser trackers task force (in WG10)		Task force leader
Articulated arm CMM task force (in WG10)		Task force leader
working groups 2, 12, 18 – document monitor		

* ISO committee membership is made up of Subject Matter Experts (SMEs). The SME1 is the designated lead for that committee, SME2 is an assigned expert, and SME3 is a non-voting position for additional experts.

PROFESSIONAL SOCIETY MEMBERSHIP

American Society of Mechanical Engineers

American Society for Engineering Education

SAE International (Society of Automotive Engineers)

NCSL International (National Conference of Standards Laboratories International)

DMSC (Dimensional Metrology Standards Consortium)

CONFERENCE ORGANIZATION

Organizer and Conference Chair, 16th CIRP Conference on Computer-Aided Tolerancing, Charlotte, NC, June 2020 (remote conference)

Technical Organizing Committee, ASPE Spring Topical Meeting, Mechanical Metrology and Measurement Uncertainty, Albuquerque, NM, April 2009

Program Committee, IEEE Intl. Symposium on Assembly and Task Planning, Montreal, Canada, July 2005

Conference Advisory Board, CAD '05, Bangkok, Thailand, June 2005

Topical co-organizer – Surface Quality: Modeling, Analysis and Measurement, IMECE 2004 (ASME Congress), Anaheim, CA, November 2004

Topical co-organizer – Design for Manufacturing, IMECE 2004 (ASME Congress), Anaheim, CA, November 2004

Organizing Committee and Session Chair, NAMRC 32, Charlotte, NC, May 2004

Organizing Committee and Session Chair, The 8th CIRP International Seminar on Computer Aided Tolerancing, Charlotte, NC, April 2003

Organizer and Conference Chair, ASPE Summer Topical Meeting, Charlotte, NC, July 2002

Organizer and Host, SAE Technical Webcast on 42V automotive systems, Charlotte, NC, March 2002

CONFERENCE SERVICE

Session Chair, NCSLI Annual Meetings, each year 2003 – 2014

Conference Chair, 12th Design for Manufacturing and Life Cycle, Las Vegas, Nevada, Sept. 2007

Conference Co-chair, 11th Design for Manufacturing and Life Cycle, Philadelphia, PA, Sept. 2006

Session Chair, Design for Manufacturing and Life Cycle, 2004, 2005

Session Co-chair, ASPE Annual Meeting, Crystal City, VA, Nov. 2001

Session Chair, Design Automation Conference, Pittsburgh, PA, September 2001

Session Chair, ASPE Summer Topical Meeting, State College, PA, June 2001

Outreach and Community Service

Served on multiple review panels at NSF, 2003 – 2009

Speaker at "CAREER Workshop" sponsored by the University Program Development office, April 2004

Mentor of a McNair Undergraduate Fellow – Summer 2003

I give frequent tutorials at the ASPE and NAMRC conferences, usually centered on Dimensional Metrology and Standardization.

PROFESSIONAL DEVELOPMENT (workshops and seminars attended)

Teaching

Attended ADVANCE workshop at UNC Charlotte focused on mid-career mentoring, March 2010.

Attended "Learning Styles and Active Learning" workshop presented by Richard Felder, June 2006.

Attended "Teaching Portfolios: The Basics" workshop, April 2003.

Participated in the "teaching circles" program, arranged by the Center for Teaching and Learning. This circle was concerned with how to evaluate and provide feedback for student writing. 2001-2002

Attended a SUCCEED (Southeastern University and College Coalition for Engineering Education) conference in Greensboro, and participated in several workshops on teaching and learning. March 2000.

Research

Attended additional grant-writing and proposal workshops as part of NSF Grantees conferences, the most recent being "Research Program Development Workshop" in Honolulu, HI, June 2009

Attended grant-writing workshop presented by Robert Lucas, February, 2001

Administration/Management

Attended the ABET 2009 Commission Summit and the Engineering-specific breakout sessions as part of this meeting, San Antonio, TX, October, 2009

Attended the ABET 2006 Commission Summit and the Engineering-specific breakout sessions as part of this meeting, Tampa, FL, October, 2006

HONORS AND AWARDS

Best paper in "Metrology Skills" track, NCSLI 2011 Annual Conference, Washington, DC.

National Science Foundation CAREER award, Specification and Analysis of Geometric Variability in Engineering Design (2003-2008)

National Research Council / Department of Energy Pre-doctoral Fellowship in Integrated Manufacturing (1995-1999.)

Annual Meeting Student Scholarship, American Society for Precision Engineering, 1998.

Nominated for the *R. Bolgiano, Sr. Outstanding Teaching Assistant Award*, Cornell, 1995