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# 1. SUMMARY

## 1.1 Education

Ph.D.- Mechanical Eng., Ohio State, 1984.

## 1.2 Honors & Awards

* ASME CIE Lifetime Achievement Award, 2012
* Boeing Performance Excellence Award, 2011
* ICED2011 Reviewers Choice Award
* ASME Design Automation Award, 2008
* Siemens Outstanding CAD Educator Award, 2009
* Best Paper Award, CIRP Tolerance conference, Annecy, FRANCE, 2009
* ICED2009 Reviewers Choice award
* Distinguished Alumnus Award, The Ohio State University, College of Engineering, 2003
* Fellow, American Society of Mechanical Engineers, 2001
* Chief Editor*, ASME Transactions*, J. of Computing & Information Science in Engineering, 2000-2010
* Editorial Advisory Board, *Computer aided Design* Journal (CAD), 2002-2006
* Area Editor, Design Computing, Research in Design Journal
* NASA/QSS Best Paper Award, ASME DfM Conference, 2002
* Best Paper Award, ASME-EIM conference, 1996
* Wakonse Teaching Fellow, 1991
* External Advisor, GE Global Research, Manufacturing research projects, 2008 - present
* Member, AIAG Automotive Industry Metrology Consortium, 2001- present

## 1.3 Academic Positions

1994- Arizona State University, *Professor*, Dept. of Mechanical & Aerospace Engineering   
1989-1993 Arizona State University, *Associate Professor*, Dept. of Mechanical & Aerospace Engineering   
1984-1988 Arizona State University, *Assistant Professor*, Dept. of Mechanical & Aerospace Engineering   
1981-1984 The Ohio State University, Graduate Teaching Assistant/Lecturer, Mechanical Engineering

## 1.4 Affiliated positions

Affiliated Faculty, Center for Interdisciplinary Research on Cognitive Adaptive Systems (CIRCAS) – emphasis area Cognitive informatics

Affiliated Faculty, Arts, Media and Engineering Institute (Digital Arts)

## 1.5 Visiting Positions

10-12/2005 Univ. of Utah, *Visiting Professor,* Dept. of Computer Science

7-10/2005 Univ. of Melbourne, Australia, *Visiting Professor,* Dept. of Mechanical Engineering

1998-1999 Univ. California at Berkeley, *Visiting Professor,* Dept. of Mechanical Engineering

Fall 1991 Helsinki University of Technology (Finland), *Visiting Professor,* Dept. of Computer Science

## 1.6 Industry Experience

5/08 – 6/08 National Inst. of Standards & Technology (NIST), Gaithersberg, MD; Visiting Scientist IPA

11/91-1/92 Philips Company, Corporate Manufacturing Center, Eindhoven, The Netherlands

Summer 91 General Motors, Advanced Engineering Staff, Warren MI

Summer 90 AlliedSignal: Garrett Engine Division, Mechanical Component Design, Phoenix AZ

Summer 86 General Electric, Corporate R & D, Automation Laboratories, Schenectady NY

1976-1980 BOC/P.O.L., Product Manager (1978-80), Product Engineer (1976-78)

1973-1975 PASMIC Steel Mills, Project Engineer, Rolling Mills.

## 1.7 Research And Teaching Interests

Computer aided design and analysis, Design computing & software development, Artificial Intelligence & Knowledge based Systems (AI/KBS) applied to design/manufacturing problems, DfM, geometric tolerance modeling, engineering informatics, Simulation software/FEA, Design theory & methodology, Cognitive studies of creativity & ideation.

# 1.8 Extra-curricular activities

Phoenix Big Brother & Big Sisters Program; Competitive running (10k, ½ and full marathons); Founder of the Phoenix Hiking Group; Volunteer, Phoenix Society for the Arts, Founder, “The Hiking Group” (800 members at its peak).

## 1.9 Leadership positions

2009 School re-organization/mergers

2007 – 09 ASU University Senate

2004 Chair, Engineering Design 2030, Strategic Planning Workshop for NSF’s

2005 Host and Co-Chair, 2005 NSF Grantees Workshop ($1.5M budget)

2004 – 06 Fulton School senate

2002 – 05 Member, MAE Graduate Committee

2000 – 01 MAE Executive Committee

2000 – 05 Director, Design Engineering & Manufacturing Automation Program (DEMAP)

1999 – 01 Chair, MAE Graduate Affairs Committee

1996 – 97 Chair, MAE Promotion & Tenure Committee

1995 – 97 MAE Graduate Affairs Committee

1995 – 97 ASU senate

1994 – 95 President, Sigma Xi, ASU chapter

1995 Chairman, NSF Strategic Planning Workshop on Engineering Design, Gold Canyon, AZ, May

1994 -03 Member, Promotion & Tenure Committee, MAE Dept.

1994 – 1996 Project Manager, The Virtual Corporation

1993 – 07 Goldwater Design Labs Co-ordinator

1993 – 95 Business-Engineering Dual Degree committee

1992 – present Director, Design Automation Lab ([http://asudesign.asu.edu](http://asudesign.eas.asu.edu))

1989 – 91 MAE Graduate Affairs Committee

1986 – 91 Co-Director, CAE & Expert Systems Lab

1986 Engineering core curriculum committee

1978 – 80 Production Manager, BOC/POL

# 2. PUBLICATIONS 2.1 Books Authored

Shah J, Mantyla M: "Parametric and Feature based CAD/CAM: Concepts, Techniques and Applications", John Wiley, New York, ISBN#0471-00214-3, 1995.

## 2.2 Books Edited

Shah J, Mantyla M, Nau D (editors): "*Advances in Feature based Manufacturing*", 20 Chapters, ISBN#0-444-81600-3, ElSevier-North Holland publisher, 1993.

## 2.3 Refereed Papers and Book Chapters (arranged by year)

**In Review**

Shah, Runger, “What’s in a Name?On the misuse of information-theoretic dispersion measures as design complexity metrics”, submitted to Journal Engineering Design, CJEN-13-0012.

**Accepted**

MacLellan, Langley, Shah, Dinar, “A Computational Aid for Problem Formulation in Early Conceptual Design”, submitted to ASME Transactions, JCISE, July 2012 (JCISE-12-1115).

J. Davidson, S. Savaliya, J. Shah , “Least-squares fit of measured points for square line-profiles”, *Procedia CIRP*, Elsevier, 2012.

**Published**

Shah, Woodward, Smith, “Applied tests of design skills – Part II: Visual Thinking,” *ASME Transactions*, J. of Mech Design, V135, July, 2013. (DOI# 10.1115/1.4024228)

Singh G, Ameta, Davidson, Shah, “Tolerance Analysis and Allocation for Design of a Self-Aligning Coupling Assembly using Tolerance-Maps,” ASME Transactions, J. of Mechanical Design, MD-10-1355, V135(3), 031005 (Feb 07, 2013).

Davidson, Savaliya, Shah: “Screws and Robotics for Metrology”, Book Chapter in Adv in Mechanisms, Robotics and Design Education, Mech & Machine Science 14, Kumar et al eds, Springer, May 2013.

Vemulpalli P, Shah J, Davidson J, “Reconciling the differences between tolerance specification and measurement methods”, Manufacturing Science & Eng Conf, ASME MESC2013, Madison, Wisconsin, June 2013. Paper#1206.

Narsale S, Chen Y, Khorshidi M, Shah J, “Design ideation framework TO support reframing and reformulation”, ASME DETC-CIE conference, Portland, Aug 2013. Paper#12391.

Haghighi P, Vemulapalli P, Mohan P, “ Preliminary Investigation On Generating An Explicit GD&T Scheme From a Process Plan”, ASME DETC-CIE Conference, Portland, Aug 2013. Paper#13123.

Jaishankar L, Davidson J, Shah J, “Tolerance Analysis Of Parallel Assemblies Using Tolerance-Maps® And A Functional Map Derived From Induced Deformations” ASME DETC-CIE Conference, Portland, Aug 2013. Paper#12394.

Jiang K, Davidson J, Shah J, Liu J, “Using Tolerance-Maps to Transfer Datum Plane from Design tolerancing to Machining TolerancING, ASME DETC-CIE Conference, Portland, Aug 2013. Paper#12722.

Mohan P, Shah J, Davidson J, “A library of feature fitting algorithms for GD&T verification of planar and cylindrical features”, ASME DETC-CIE Conference, Portland, Aug 2013. Paper#12612.

He Y, Davidson J, Shah J, “Tolerance maps for line profiles constructed from Boolean ops”, ASME DETC-CIE Conference, Portland, Aug 2013. Paper#12393.

Khorshidi M, Shah J, Woodward J, “Rethinking the comprehensive test on qualitative reasoning for design”, ASME Design Theory & Meth Conference, Portland, Aug 2013. Paper#12403.

Cagan, Dinar, Shah J, Leifer, Linsey, Smith, Hernandez, “Empirical studies of design thinking: Past, present, future”, ASME Design Theory & Meth Conference, Portland, Aug 2013. Paper#13302.

J. Davidson, S. Savaliya, J. Shah , “Using planar kinematics to construct full 4D tolerance map for line profile”, ASME DETC-CIE Conference, Portland, Aug 2013. Paper#12682.

Davidson J, Shah J, “Modeling of geometric variations for line-profiles”, *ASME Transactions* JCISE12-1036, V12(4), 2012, DOI 041004.

Uckun, MacKey, Do, Zhou, Huang, Zhang, Ke, Shah, “Alternative Measures of Product Design Adaptability for Changing Requirements”, DETC 2012/70463, ASME CIE conf, Chicago, Aug 2012.

L. Jaishankar, J. Davidson, J. Shah, “Representing stresses that arise in parallel assemblies that contain imperfect geometry allowed by tolerances”, ASME DETC 2012-70208, DFM conference, Chicago, Aug 2012.

Khorshidi, Woodward, Shah, “Towards a Comprehensive test of qualitative reasoning skills in design,” ASME Design Theory & Meth conf, Chicago, Aug 2012, DETC-70657.

Danielscu, Dinar, MacLellan, Shah, Langley, “What Problem Maps can tell us about Problem Formulation and Creative Designers”, ASME Design Theory & Meth conf,, Chicago, Aug 2012, DETC-70325.

Singh, Balaji, Shah, Corman, Matikalli, Stuart, Howard, “Evaluation of network measure as design complexity metrics,” ASME Design Theory & Meth conf,, Chicago, Aug 2012, DETC-70483.

Davidson, Savaliya, Shah, “Methods of Robotics and the Pseudoinverse to Obtain the Least-Squares Fit of Measured Points on Convex Line-Profiles” submitted to ASME DETC conf,, Chicago, Aug 2012, DETC-70203.

Mohan, Shah, Narsale and Khorshidi Capturing, “Ideation Paths for Discovery of Design Exploration Strategies in Conceptual Engineering Design”, Design Computing & Cognition conf, Texas A&M, June 2012.

Dinar, MacLellan, Shah, “Beyond Function-Behavior-Structure models”, Design Computing & Cognition conf, Texas A&M, June 2012.

J. Davidson, S. Savaliya, J. Shah , “Least-squares fit of measured points for square line-profiles”, CIRP Comp aided Tolerancing conf, UK, April 2012.

Shah J, Woodward J, Smith S, Milsap R, “Applied tests of design skills – Part 1: Divergent thinking”, ASME *J. Mech Design,* V134, Feb 2012.

Shah J, Woodward J, “Applied Tests of Engineering Design Skills: Visual Thinking Characterization, Test Development And Validation”, 2011 Int Conf Eng Design, Denmark. (Reviewers Choice Award)

Dinar M, Shah J, Langley P, “A data structure for representing design problem formulations”, 2011 Int Conf Eng Design, Denmark.

Mani N, Shah J, Davidson J, “Standardization of CMM Fitting Algorithms and Development of Inspection Maps for Use in Statistical Process Control”, ASME Manufacturing Engineering Conf, Oregon, 2011.

Mohan M, Chen Y, Shah J, “Towards a framework for holistic ideation in conceptual design,” ASME CIE conf, Washington DC, Aug 2011, Paper#47589.

Grishin A, Shah J, “A meshfree b-spline finite element formulation for unilateral contact problems”, ASME DAC, Washington DC, Aug 2011, Paper#47776.

Shen Y, Shah J, Davidson J, “DOF Algebra for Geometric Dimensioning & Tolerancing”, ASME IDETC, Washington DC, Aug 2011, Paper# 47937.

Dinar M, Shah J, Hunt G, Campana E, Langley P, “Towards a formal representation model of problem formulation in design”, ASME DTM conf, Washington DC, Aug 2011, Paper#DTM-48396.

Shah J, Runger G, “Misuse of information-theoretic dispersion measures as design Complexity metrics”, ASME IDETC, Washington DC, Aug 2011, Paper#DTM-48295.

Davidson J, Shah J, “Modeling of geometric variations for line-profiles”, ASME DETC 2011, Paper 47507.

Ameta,. Davidson,. Shah, “Effects of SIZE, Orientation and Form Tolerances on the Frequency Distributions of clearance between two planar faces”, ASME Transaction JCISE,V11(1).

Vargas-Hernandez N, Shah J, Smith S, “"Understanding Design Ideation Mechanisms through Multilevel Aligned empirical Studies", *Design Studies,* 2009. Volume 31 (4), July 2010, pages 382-410. **(2010 Best Paper Nominee)**

Khan N, Shah J, Davidson J, “Probability Tolerance Maps: A New Statistical Model for Non Linear Tolerance Analysis Applied To Rectangular Faces”, ASME CIE conf, Montreal, Paper “DETC2010-28937, Aug 2010.

Shah J, Millsap R, Woodward J, Smith S, “Applied Tests of Design Skills: Divergent Thinking Data Analysis and Reliability Studies”, ASME DTM Conference, Montreal, Aug, 2010, Paper DETC2010/DTM-2888.

Dixon A, Shah J, “Intelligent feature tutor and recognition algorithms for assembly features,” CAD & Applications conf, Dubai, June 2010. (also published as journal paper in CAD & A, V7  N3  Pages 319-333, 2010, DOI: 10.3722/cadaps).

Summers J, Shah J, “Mechanical engineering design complexity metrics: Size, coupling and solvability”, J. Mechanical Design, *ASME Transactions*, V132, Feb 2010.

Ameta,. Davidson,. Shah, "Influence of form on Tolerance-Map-generated frequency distributions for 1-D clearance in design," *Precision Engineering,* PRE-D-07-00083R1, V34(1), pp 22-27, Jan 2010. (pp 011005-1 to -13)

Ameta G, Davidson J, Shah J, “Statistical Tolerance Allocation for Tab-Slot Assemblies utilizing Tolerance-Maps”, *ASME Transactions* JCISE, V10(1), March, 2010 <http://dx.doi.org/10.1115/1.3249576>

Smith S, Kerne A, Koh E, Shah J, “The Development and Evaluation of Tools for Creativity”, Book Chapter, Tools for Innovation Book, Markman & Wood (eds), Oxford University Press, , Sep 2009, ISBN-13:978-0-19-538163-4, (doi:10.1093/acprof:oso/9780195381634.003.0007)

Shah J, Woodward J ,Smith S, “Development of Standardized Tests For Design Skills”, Intl Conf On Eng Design ICED09, Stanford, Aug, 2009.

Murshed M, Dixon A, Shah J, “Neutral Definition and Recognition of Assembly Features For Legacy Systems Reverse Engineering”, ASME Design Tech Conferences, DETC2009-86739, San Diego, Sep 2009.

Clasen P, Davidson J, Shah J, “Modeling Of Geometric Variations Within A Tolerance-Zone For Circular Runout”, ASME Design Tech Conferences, DETC2009-86283, San Diego, Sep 2009.

Singh, G., Ameta, G., Davidson, J.K., and Shah, J.J. "Worst-Case Tolerance Analysis of a Self-Aligning Coupling Assembly using Tolerance-Maps," In CD-ROM Proc., 11th CIRP Int'l Conference on CAT (ed. F. Villeneuve and M. Giordano), March 26-27, 2009, Annecy, France. **(CIRP Best Paper Award)**

Davidson J & Shah J, “Generalized size T-maps for planar faces of any convex cross-section by isosceles triangulation”, CIRP Computer aided Tolerancing, CATS 2009, March 2009

Shen Z, Shah J, Davidson J, "Automatic Generation of Min/Max Tolerance Charts for Tolerance Analysis from CAD models"  *Intl Journal of Computer Integrated Manufacturing,* V21(8) pp 869-884, 2008.

Shen Z, Shah J, Davidson J, “Analysis neutral data structure for GD&T”, *J. Intelligent Manufacturing*, V19(4), pp 455-472, 2008.

Shah J, “Empirical Methods for Studying Design Ideation: Critical analysis”, NSF Workshop on Studying Creativity, March 2008, Aix-en-Provence, France.

Smith S, Kohn N and Shah J., “What You See Is What You Get: Effects of Provocative Stimuli in Creative Invention,” NSF Workshop on Studying Creativity, March 2008, Aix-en-Provence, France.

Shah J, Ameta G, Shen Z, Davidson J, Navigating the Tolerance Analysis Maze, *CAD & Applications Journal,* V4 N5, pp 705-719, 2007.

Li, S, Shah J, “Recognition of user defined turning features for mill-turn parts”, *ASME Transactions*, J. of Computing & Information Science in Eng, V7N3, Sep 2007, pp 225 – 235.

Ameta G., Davidson J. K., Shah J. J., “Tolerance-Maps Applied to A Point-line Cluster of Features”, ASME Transactions, *J. of Mechanical Design*, Aug 2007.

Ameta, Joseph K. Davidson & Jami J. Shah, “Using Tolerance-Maps to Generate Frequency Distributions of Clearance and Allocate Tolerances for Pin-Hole Assemblies”, *ASME Transactions*, J. of Computing & Information Science in Eng,, Dec 2007, pp 347-359.

Vargas-Hernandez N, Shah J, Smith S, “Cognitive Models of Design Ideation”, ASME DTM conf, 2007, Las Vegas.

Ameta G., Davidson J. K., Shah J. J., “Using Tolerance-Maps to Generate Frequency Distributions of Clearance for Tab-Slot Assemblies, ASME CIE conf, IDETC2007/CIE-35162, 2007.

Murshed M, Shah J, Jagaswami V, Wasfy, D. Hislop “ OAM+: An assembly data model for Legacy Systems Engineering”, ASME DAC conf, DETC2007-35723, 2007.

Ameta G., Davidson J. K., Shah J. J., “Influence of Form on Frequency Distribution for 1-D Clearance Generated from Tolerance-Maps”, 2007 CIRP Tolerance Conference, Paris, France.

Shen Z, Shah J, Davidson J., “Virtual part arrangement in assemblies for automatic tolerance chart based stackup analysis”, #DETC2006-99184, 2006 ASME CIE conf, Philadelphia, Sep 2006.

Shah J, Smith S, Vargas-Hernandez N, “Empirical Studies of Design Ideation”, Paper#DETC2006-99642, 2006 ASME Design Theory Conf, Philadelphia, Sep 2006.

Ameta G, Davidson J, Shah J, “Using Tolerance-Maps to Generate Frequency Distributions of Clearance for Pin-Hole Assemblies”, Paper # DETC2006-99585, 2006 ASME Design Automation Conf, Philadelphia, Sep 2006.

Smith, S. M., Gerkens, D. R., Shah, J., & Vargas-Hernandez, N. “Empirical studies of creative cognition in idea generation”, In L. Thompson & H. Choi (Eds). Creativity and Innovation in Organizational Teams, Lawrence Erlbaum, NJ, 2005.

Shen, Z., Ameta, G., Shah, J. J. and Davidson, J. K., 2005, "A Comparative Study of Tolerance Analysis Methods", *ASME Transactions*, J. of Computing & Information Science in Eng, V5(3), September, 2005.

Zhao Z, Shah J, “Domain Independent Shell for DfM and its Application to Sheet Metal Forming and Injection Molding”, *Computer Aided Design*, V37, pp881-898, 2005.

Sridharan N., Shah J., “Recognition of Multi-axis Features: Part II – Algorithms & Implementation”, *Journal of Computing & Information Science*, V5(2), March 2005, pp 25-34.

Shah J., “Identification, Measurement & Development of Design Skills In Engineering Education”, Int Conf on Eng Design (ICED05), Melbourne, Australia, August, 2005.

Vargas N, Shah J, “Development of a Computer Aided Conceptual Design Tool for Electro-mechanical design”, Int Conf on Eng Design (ICED05), Melbourne, Australia , August, 2005.

Shen, Z., Shah, J. J. and Davidson, J. K, “Simulation-Based Tolerance and Assemblability Analyses of Assemblies with Multiple Pin-Hole Floating Mating Conditions”, ASME CIE conf, Long Beach, California, Sep. 2005, #DETC2005-85398.

Joshi N., Shah, J., "On the viability of developing CAD data exchange standard for form features", ASME CIE Conference, Long Beach, California, Sep. 25~28, 2005**, #DETC2005-85606.**

Shen, Z., Shah, J. J. and Davidson, J. K, “A Complete Variation Algorithm for Slot and Tab Features for 3D Simulation-Based Tolerance Analysis”, ASME Design Automation Conf, Long Beach, California, Sep. 2005, #DETC2005-85541.

Li Shiqao, Shah J, “Recognition of Interacting Turning Features for Mill/Turn Parts”, Proc. ASME DAC conf, Long Beach, CA, Sep 2005, Paper DETC2005-85431.

Ameta G, Davidson J, Shah J, “Tolerance-Maps Applied to a Point-Line Cluster of Features”, ASME Design Automation Conf, Long Beach, California, Sep. 2005Paper #DETC2005-85115.

Jian A. D., Ameta G., Davidson J. K., Shah J. J., "Tolerance Analysis and Allocation using Tolerance-Maps for a Power Saw Assembly ", Proceedings of 9th CIRP 2005 Seminar on Computer Aided Tolerancing.

Bhide S., Ameta G., Davidson J. K., Shah J. J., "Tolerance-Maps Applied to the Straightness and Orientation of an Axis", Proceedings of 9th CIRP 2005 Seminar on Computer Aided Tolerancing.

Ameta G, Davidson J, Shah J , “Allocating Tolerances Statistically With Tolerance-Maps and Beta Distributions: The Target a Planar Face”, Paper #DETC2005-85122.

Shen, Z., Shah, J. J. and Davidson, J. K., "On Coupling of Tolerances and Assemblability Analysis through A Pin-Hole Assembly with Multiple Floating Mating Conditions", 9th CIRP Intl. Seminar on Computer-Aided Tolerancing, Tempe, April 2005.

Sridharan N., Shah J., “Recognition of Multi-axis Features: Part I - Topological and Geometric Characteristics”, ASME Transactions, *Journal of Computing & Information Science*, V4(3), September, 2004, pp 242-250.

Summers J., Shah J., “The Design Exemplar: A New Data Structure for Embodiment Design Automation”, *Journal of Mechanical Design*, ASME Transactions, V126(5), Sep 2004, pp 775-787.

Vargas-Hernandez N., Shah J., “2nd-CAD: A Tool for Conceptual Design of Electromechanical Systems”, *Journal of Computing & Information Science*, V4 (1), March, 2004, pp 28-36.

Mujezinovic, A, Davidson, J, and Shah, J “A New Mathematical Model for Geometric Tolerances as Applied to Polygonal Faces”, ASME Transactions, *J. of Mechanical Design*, V126(3), pp 504,518, March 2004.

Zhao Z, Shah J, “Domain independent DfM framework with application to sheetmetal manufacturability evaluation”, CAD Conferences & Exhibition ’04, Pattaya Beach, Thailand, May 24-28, 2004. (also accepted for special issue of *CAD journal*)

Montero, Vargas, Wright, Shah, “X-talk: Collaborative Framework Requirements for Electronic-Mechanical Product Design”, CIRP 2004 Design Seminar , Cairo, Egypt, May 16-18, 2004.

Summers J, Shah J, “Exemplar networks: extensions of the design exemplar”, ASME-CIE conference, Salt Lake City, paper#57786, Sep, 2004.

Summers J, Shah J, “Representation in engineering design: a framework for classification”, ASME-Design Theory & Methodology Conference, paper #57514, Salt Lake City, Sep, 2004.

Zhao Z, Shah J, “Modeling and representation of manufacturing knowledge for DFM systems”, ASME-CIE conference, 2004. (**nominated for Best Paper Award**)

Shen Z, Ameta G, Shah J, Davidson J, “A Comparative Study of Tolerance Analysis Methods”, ASME-CIE conference, 2004. (**nominated for Best Paper Award**)

Medichalam M, Shah J, D’Souza R, “N-Rep: A neutral Feature Representation to support feature mapping and data exchange across applications”, 24th ASME Computers and Information in Engineering (CIE) Conference, Salt Lake City, Utah, 2004.

Ameta G, Davidson J, Shah J, “The effects of different specifications on the tolerance maps for angled faces”, ASME Design Automation Conf, 2004.

Wu Y., Shah J., Davidson J., “Algorithms for computing Minkowski sums of 3-Polytopes”, *Computer aided Design Journal*, V35(13), Nov 2003, pp 1181-1192.

Bettig, B., Shah, J., “Solution Selectors: A User-Oriented Answer to the Multiple Solution Problem in Constraint Solving”, *ASME Transactions*, Journal of Mechanical Design, V125(3), pp. 443-451, 2003.

Wu Y., Shah J., Davidson J., “Computer modeling of geometric variations in mechanical parts and assemblies”, *ASME Transactions*, J. of Computing & Information Science, V3(1), March 2003.

Shah J., Smith S., Vargas-Hernandez N., "Metrics for measuring ideation effectiveness", *Design Studies*, V24(2), 111-134, March 2003.

Davidson J., Shah J, “Using  tolerance-maps®  to  represent  material  condition on  both  a  feature  and  a  datum”,  
 8th CIRP Seminar on Computer Aided Tolerancing, UNCC, Charlotte, June 2003.

Summers J., Shah J., “Developing Measures of Complexity for Engineering Design Problems”, Proc. ASME Design Theory & Methodology Conference, Chicago, Sep, 2003.

Tharakan P, Zhao Z, Shah J, “A Re-Configurable Environment For Technical And Economic Manufacturability Evaluation” Proc. ASME DFM conference, Chicago, Sep, 2003.

Shah J, Smith S, Vargas N, Gerkens D, Muqi W, “Empirical Studies Of Design Ideation: Alignment of Design Experiments with Lab Experiments” Proc. ASME DTM conference, Chicago, Sep, 2003.

Shen Z, Shah J, Davidson J, “Automation of Linear Charts and Extension to Statistical Tolerance Analysis”, Proc. ASME CIE conference, Chicago, Sep, 2003.

Bhide S, Davidson J, Shah J, “A new mathematical model for geometric tolerances as applied to axes”, Proc. ASME DAC conference, Chicago, Sep, 2003.

Vaidya A, Shah J, “Design shell for parametric design at embodiment stage”, Proc. ASME DAC conference, Chicago, Sep, 2003.

Vargas N, Shah J, “Development of a computer aided conceptual design tool for complex electro mechanical systems”, American Assoc for Artificial Intelligence (AAAI) symposium on Computational Synthesis, Stanford, March 2003.

Davidson J., Shah J., “Geometric Tolerances: A new application for line geometry and screws”, *IMechE Journal* Mechanical Engineering Science, V216, Part C, pp 95-103, 2002.

Miao H, Sridharan N., Shah J, “CAD-CAM Integration Using Machining Features”, *Int. J. Computer aided Manufacturing,* V15 (4), 296-318, 2002.

Davidson J., Shah J., Mujezinovic A., “A new math model for geometric tolerances as applied to round faces”, *ASME Transactions*, Journal of Mechanical Design, V124(4), 609-623, Dec 2002.

Summers J., Lacroix Z., Shah J, “Case based design facilitated by the design exemplar”, Proc. Artificial Intelligence in Design Conference, 453-476, Cambridge, UK, 2002.

Vargas N., Shah J.,Lacroix Z “Knowledge representation for conceptual engineering design”, Proc. Of Software Eng., Artificial Intelligence, Networking and Distributed Computing, SNPD02, 45-52, Madrid, Spain, June 2002.

Bettig B., Summers J., Shah J., “Geometric exemplars – a bridge between AI and CAD,” Book Chapter, *IFIP Knowledge Intensive CAD to Knowledge Intensive Engineering*, pp 45-58, Kluwer, Netherlands, 2002.

Summers J., Shah J., “Leadership based Evolution Architecture for Engineering Design”, Book Chapter, *IFIP Knowledge Intensive CAD to Knowledge Intensive Engineering*, pp 13-26, Kluwer, Netherlands, 2002.

Wu Y., Shah J., Davidson J., “Rationalization and computer modeling of GD&T classes”, ASME CIE conference, CD ROM proceedings, Paper#DETC2002/CIE-34482, Montreal, Oct, 2002.

Zhao Z., Shah J., “ A Normative Framework for DfM based on Benefit-Cost Analysis”, ASME DFM Conference, CD ROM proceedings, Paper#DETC2002/DFM-34176, Montreal, Oct, 2002. (given **NASA-QSS Best Paper Award**)

Fernando R., Shah J., “Integration of commercial CAD/CAM system with custom CAPP using Orbix Middleware and CORBA standard”, CD ROM proceedings, Paper#DETC2002/DAC-34069, Montreal, Oct, 2002

Summers J., Shah J., “Empirical studies for evaluation and investigation of a new knowledge representation structure in design automation”, Paper#DETC2002/CIE-34488, Montreal, Oct, 2002.

Davidson J., Shah J., “Tolerance Maps: Point-spaces that represent feature variations specified by geometric tolerances” ASPE Summer Topical Meeting on Tolerances Modeling & Analysis, Charlotte, 2002.

Kandikjian T., Shah J., Davidson, “A mechanism for validating dimensioning & tolerancing schemes in CAD systems”, *Computer aided Design*, V33(10), 721-737, July 2001.

Shah J., D. Anderson, Kim Y-S, S. Joshi, “A Discourse on Geometric Feature Recognition from CAD Models”, J. of Computing & Information Science in Engineering, *ASME Transactions*, V 1(1), pp 41 – 51, March 2001.

Bettig B., Shah J., “Derivation of a standard set of geometric constraints for parametric modeling and data exchange”, *CAD Journal,* V33, pp17-33, 2001.

Shah J., Vargas-Hernandez, Summers, Kulkarni, “Collaborative Sketching (C-Sketch) - an Idea Generation Technique for Engineering Design”, *J. Creative Behavior,* V35(3), 168-198, 2001.

Bhide S., Davidson J., Shah J., “Areal Coordinates: The basis of a mathematical model for geometric tolerances”, Proc. 7th CIRP Seminar on Comp. Aided Tolerancing, Cachan, France, April 24-25, 2001.

Summers J., Hernandez N., Zhao Z., Shah J., Lacroix Z., “Comparative study of representation structures for modeling function and behavior of mechanical devices”, ASME Computers in Engineering Conf., Pittsburgh, Sep 2001 – paper# DETC01/CIE-21243.

Davidson J., Mujezinovic A., Shah J, “A new math model for geometric tolerances as applied to polygonal faces”, ASME Design Automation Conference, Pittsburgh, Sep 2001.

Ramaswamy S., Shah J., Davidson J., “Computer aided GD&T advisor based on Y14.5 conformance and good practice”, ASME Design for Manufacturing conf., Pittsburgh, Sep 2001 – DETC01/DFM-21172.

Bettig B., Shah J., “Solution Selectors: A User-Oriented Answer To The Geometric Constraint Multiple Solution Problem”, 2001 ASME Design Eng. Tech. Conferences, September 10-13, 2001, Pittsburgh, DETC01-DAC084.

McKoy F., Hernandez N., Summers J., Shah J., “Influence of design representation on effectiveness of idea generation”, ASME Design Theory & Methodology conf., September 10-13, 2001, Pittsburgh, Paper#DTM-21685.

Venkataraman S., Shah J., “Investigation of Integrating Design by Features and Feature Recognition”, IFIP Conf, FEATS 2001, Valenciences, France, June 2001.

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Wilson, P., Shah J., “Linking Design - Manufacturing via Advanced Solid Modeling”, Whit Paper, Air Force Office of Scientific Research, 1986.

Shah, J., “A Scheme for CAD-CAPP Integration Using Group Technology”, Report, GE Corp R&D, 1986.

## 2.5 Invited Talks/ Seminars

Lawrence workshop on metrology standards, “Trials and tribulations of developing dimensional standards”, Sedona, AZ, May 2013.

Hyundai Motors, “Mathematical modeling of geometric t9olerances to support precision engineering”, R&D Center, Yangjae-dong, S.Korea, May 2013

Cog Sci conference, “Cognitive studies of design thinking:, Sogang University, Seoul, S. Korea, May 2013.

Creative Design Institute, “Science & Art of Design Ideation”, SKKU Seoul campus, S. Korea.

HKUST, “Applications of T-maps to tolerance analysis and CMMs”, IE Dept semina, Hong Kong, March 2013.

Toy Design Competition, “Generating great ideas”, HKUST, March 2013.

COFES12- Ideation Guru- Scottsdale AZ, April 2012

META metrics workshop, “NNUWER complexity metrics development”, July 20th 2011, Washington DC.

META workshop, “Valuation versus architecture based adaptability formulation”, July 20th 2011, Washington DC

Carnegie-Mellon Univ, “Standardized tests of design skills”, ME Dept seminar, Pittsburgh, Oct 29th, 2010.

Wright-Pat Air Force Base, “Next generation CAD systems”, Nov 12th, 2010.

American Helicopter Electromagnetics, “Geometry data exchange for EE simulations”, Mesa, Nov 17th, 2010.

Intel ETD, “Science & Art of Technological Ideation”, Chandler, AZ, Nov, 2009.

ASU Tempe, “Adding intelligence to mechanical CAD systems”, MAE Dept seminar (invited), November, 2008.

IIT Chicago, “Towards CAD systems for Conceptual Design”, MME Dept. seminar, October, 2008.

CAD&A conf plenary, “Tolerance analysis methods for mechanical design”, Honolulu, Hawaii, June 2007.

GE Research, “Design and metrology research at DAL”, Center seminar, Niskayuma, NY, Sept, 2006.

NIST MEL, “N-Rep language and recognition of user defined features”, Gathersburg, MD, June 2006.

UNC Charlotte, “Evaluation of ideation techniques for engineering design”, Nov, 2005.

U. Utah, “Research opportunities for computational research in engineering design”, Salt Lake City, Oct 2005.

U. Melbourne, “Feature recognition techniques”, Melbourne, Australia, July, 2005.

Washington State U, “Design ideation in conceptual design”, MME Dept seminar, Pullman, April 2005.

Intel, “Navigating the Tolerance Analysis Maze”, Chandler, March 2005.

NSF EXCITED Workshop, “Engineering Design perspective on Cyber-infrastructure”, Washington, Feb, 2005.

CI-OR workshop, “Cyberinfrastructure for Engineering Design”, Washington DC, Aug 2004.

Sandia, “Evolution of feature recognition through 4 generations”, Meshing Roundtable Keynote, Sante Fe, Sep 03.

Univ Autonoma de Baja California, “What makes feature recognition hard?”, ME Dept seminar, Mexicali, May 03.

UNLV, “Empirical studies of design idea generation”, ME Dept seminar, Las Vegas, April 2003.

AIAG conference, “Math modeling of GD&T consistent with ASME Y14.5 standard”, Tempe, April 2002.

AIAG Metrology Consortium, “Fundamental issues for computer modeling of GD&T”, Southfield, MI, Nov, 2001.

Korea CAD/CAM Society, “Modeling of geometric variations”, Keynote lecture, Kyungju, Korea, July, 2001.

Gordon Research Conf., “Assessment metrics for conceptual design methods”, Plymouth, NH, June 2000.

Ford Motor Co., Visteon, “Automatic recognition of 3, 4, and 5 axis NC milling features”, Dearborn, Oct. 1999.

Univ. California, Irvine, “Mathematical model for geometric tolerances”, ME Dept. seminar, Oct. 1999.

Harvey Mudd College, “Skill based designer profiles: identification & evaluation”, Luncheon speaker, May 1999.

Univ. of Tokyo, “Parametrics: Past, present, future”, Keynote lecture, GEO-6 conf., Tokyo, Dec 1998.

Shanghai Jio-Tong U., “Design history archival & retrieval”, Shanghai, Dec 1998.

China Academy of Science, Inst. Computing, “Design by features and recognition-state of art”, Beijing , 1998.

Zhejiang Univ., CHINA, “Review of design by features and feature recognition”, Huangzhou, Dec 1998.

Northwestern Polytech, CHINA, “Design history archival & retrieval”, Xian, Dec 1998

UC Berkeley, “Mathematical modeling of geometric tolerances”, Berkeley , Nov, 1998.

UC Berkeley, “Boeing’s Integrated Product Design Environment”, Berkeley, Nov, 1998.

Stanford Univ., “ Feature recognition methods comparison”, Nov. 1998.

UC Berkeley, “Feature Recognition Techniques I, II, III, IV”, Berkeley Stanford, lecture series, Sep-Oct, 1998.

Gordon Conf., “Structured Intuition: Promise or Hyperbole?”, Product design & mfg., NH, June 1998.

NCMS-DHBrown, Detroit: “Is commercial feature based CAD production worthy yet?”, Sep 1997.

ASPE, Papago Chapter: “New paradigms in teaching engineering design”, April 1997.

Univ. Lyon, FRANCE: "Research issues in feature based design and manufacturing", Sep 1996.

EDS, Cypress CA: "Techniques for mapping design features to manufacturing features", Aug 1996.

IMA-CNR Italy: "Features Technology- State of the art", Keynote address, Geonova, Nov 1994

Ford Alpha Manufacturing, Dearborn: "Features & group Technology", June 1994.

Garret Fluid Systems, Tempe: "Alternative approaches to Knowledge Engineering for Design", Sep 1993.

LTD Finance Dept., Las Vegas: "Creative problem solving techniques", June 1993.

AAMA, Detroit: "Application of features technology in the automobile industry", Feb 1993.

EDS/Unigraphics, Cypress CA: "Design of ASU Design Environments", Nov 1992.

Leeds University, Mech Eng(UK): "Synergetic Design Systems", Aug 1992.

Edinburgh University, Mech Eng (UK): "Overview of ASU Design Systems", Aug 1992.

Loughborough University(UK): "Features Testbed", Aug 1992.

Cambridge University, Eng Design Centre (UK): "Features Technology - Research", Aug 1992.

Bristol University, Eng. Math Dept. (UK): "Overview of ASU Design Systems", Workshop Keynote, Aug 1992.

Tech University of Delft (HOLLAND): " The ASU Features Testbed", Delft , Dec 1991.

Philips CFT Lecture, Eindhoven (HOLLAND), " Management perspective on Features", Nov 91.

USSR Academy of Sciences, Inst of Computing, Moscow, " Features Tech: State of the art", Nov 1991.

Helsinki Univ Tech (FINLAND): " Domain independent shell for routine mech design", Espoo, Oct 1991.

GM Tech Center, Warren, " Design environments, Design Advisors & Expert Systems", July 1991.

Georgia Tech: "Unresolved problems in Feature Modeling", Atlanta, May 1991.

CAM-I Features Workshop: "Status of Features Technology; Derivation of Functional requirements", International Symposium, Keynote Speaker, Boston, August 1990.

IBM, San Jose, "Integrating Feature Based Modelers with Knowledge-Based Applications", June 1989.

U. of Michigan: "Design of Design Environments", Mech. Engr. Dept. Seminar, Ann Arbor, January 1989.

Ohio State: "Design Manufacturing Integration," Mech-Eng Dept. Seminar, Columbus, May 1988.

SDRC, Cincinnati: "Research Issues in Feature Modeling," May 1988.

CAMI-GMP: "Current Status of Geometric Modeling," Scottsdale, February 1988.

Dept. of Navy, San Diego "Feature data standardization," February 1988.

CAMI – GMP, Portland, "Functional Reqs and Conceptual Design of Feature Modeling System," Aug 1987.

Hewlett-Packard Labs, Palo Alto: "Feature Modeling," California, June, 1987.

G.E. Corporate R&D, Schenectady, New York: "Form Synthesis Research," August, 1986.

# 3. Research Projects (*Unless otherwise stated, J. Shah was the sole PI on grants listed above)*

|  |  |  |
| --- | --- | --- |
| **Title & Date** | **Sponsor** | **Status** |
| Process plan variability analysis | DARPA-AVM Foundry (subcontract PennState) | selected; in contract negotiation |
| Manufacturability evaluation based on datum flow chains | DARPA-iFAB (subcontract PARC) | funded- active |
| Discovering Design Patterns from Holistic Ideation Web Tools (2011- | NSF | funded-active |
| Metrics and tools for design complexity and adaptability (Boeing subcontract) – 2010-2011 | DARPA-META2 | funded |
| FRACSAT: An Integrated Lifecycle Support Toolkit for Fractionated Spacecraft Architectures (with NASA JPL and Palo Alto Res Center) -2011-2012 | DARPA- F6 | funded |
| Understanding and Aiding Problem Formulation in Creative Conceptual Design (2010-213) w P. Langley | NSF-CreativeIT | funded-active |
| Virtual Synectics++: Holistic Ideation Testbed for Creative Design (2010-2012) | NSF-CcreativeIT | funded; active |
| Math based precision manufacturing and metrology for complex mechanical assemblies, 2010-13 (with J. Davidson) | NSF-CMMI | funded; active |
| Identification, characterization and measurement of design skills in conceptual design (2007-11) | NSF-CMME | Funded; active |
| Manufacturing T-Maps: A New  Math Model For 3-D Tolerance Analyses In Process Planning, CMM Inspection & SPC (with J. Davidson)-2007-09 | NSF-CMME | Funded; completed |
| Assembly feature recognition (2008-09) | ARO sub | funded |
| Feature recognition and manufacturability evaluation for LSE (2006-09) | Hampton (ARO) | Funded; completed |
| Rapid Re-engineering Testbed for Legacy Parts Re-manufacturing (2005-08) | ARO | funded; completed |
| EDS software suite for teaching CAE: SolidEdge, Unigraphics and IDEAS – 200 seats (2004) | EDS PLM | Gifted |
| Engineering Design 2030: Strategic Planning Workshop(2004-05) | NSF-ED | Funded; complete |
| NSF 2005 Grantees Conference (11/03-6/05) | NSF-DMI | Funded; completed |
| STEP AP203 to AP224 conversion (8/03-3/04) | Army Res Ofc | Funded; completed |
| Mathematical model to formalize tolerance specifications and support comprehensive 3D analysis (with J. Davidson, PI) 2003-06 | NSF-ED | Funded;completed |
| Development and validation of design ideation models for conceptual engineering design  (S. Smith, Texas A&M, co-PI) 2001-2006 | NSF-ED | Funded;completed |
| Mechanical Computer aided Engineering Lab | INTEL | Funded (in operation) |
| Investigation of DfM metrics and methods (w/ P. Wright at UCB as co-PI) 2001-2004 | NSF-ED | Funded (completed) |
| Conceptual CAD (2000-02) | FORD | Funded (completed) |
| Math modeling of geom. variations to integrate parametric CAD with tol. analyses (J. Davidson, PI) (1999-2002) | NSF-ED | Funded  (completed) |
| Unified theory of topological and geometric problems in mechanical design (1998-2001) | NSF-Integ. Eng. | Funded  (completed) |
| Operation variables and metrics for evaluating group creativity techniques (1998-2000) | NSF-DTM | Funded  (completed) |
| Modeling, simulation, animation for real time control (Rodriguez, PI + 6 others) 1996-99 | NSF | Funded |
| Integrated Engineering Analysis model (with Boeing Defense and MacNeal Schwendler Corp.)  J. Shah, PI for ASU sub-contract (1996-1998) | DARPA-RaDEO / Boeing | Funded  (completed) |
| ENGEN- Data exchange of constraints and design histories (with SCRA, Ford, CV, SDRC, PTC) , (1996-98) | DARPA-ATP | Funded  (completed) |
| Computational tools for feature mapping,: D&T mapping and machining algebra (1995-98) | NSF- DMII. | Funded  (completed) |
| Manufacturing across the curriculum- The Virtual Corp. [with 7 co-PIs] (1994-97)] | NSF/ DARPA-TRP | funded  (completed) |
| PARASOLID Development System | EDS | funded |
| Feature based design and STEP data models for power train and inner panel components (93-94) | USCAR consortium | funded  (completed) |
| HP University Grants Program: MCAE Lab(1992-93) | Hewlett Packard | funded  (completed) |
| Mapping design features to manufacturing features using meta knowledge(1992-95) | NSF  -IE | funded  (completed) |
| Infrastructure for active design databases and design histories (P.I: J Shah, Co-PI: S.Urban) (1992-95) | NSF  CISE | Funded  (completed) |
| Functional reqs and design of feature  based modeling system(1988-90) | CAM‑I consortium | funded  (Completed) |
| Expert solid modeling shell for integrated  product engineering Phase I (1988-89) | NSF | funded  (Completed) |
| Concurrent design shell for mechanical component design - seed project (1989-91) | Allied-Signal | funded  (Completed) |
| Knowledge based system for life cycle design of FRTP composites | ICI Composite  Structures Inc. | funded (Completed) |
| Feature based design and manufacturing Phase II (89-90) | Texas Instruments | funded (Completed) |
| Creation and application of design by feature and costing system - Phase I (1987-1989) | Texas Instruments | funded (Completed) |
| Automatic Group Technology coding from feature database (1987-1988) | GE Corporate R&D | funded (Completed) |
| CAE & Expert Systems Lab (1987) | TI | Funded- completed |
| Research equipment for AI workstation (P.I. Shah, Co P.I. Henderson)-1985-86 | NSF | Funded-completed |

# 4. THESES/DISSERTATIONS CHAIRED 4.1 Theses/dissertations completed

Ying Chen, MS (9/10 – 8/12)

“Cascading evolutionary morph charts for holistic ideation framework”, NSF EDI Program

Srikant Balaji, MS (1/09 – 9/11 )

“MATSUB: Fuzzy logic based material substitution advisor for legacy parts”, ARO (partial)+DARPA (partial)

Manikandan Mohan, MS (9/10 -12/11 )

“A framework for holistic ideation in conceptual design”, NSF

Gurpeet Singh, MS (9/10 – 12/11 )

“Complexity metrics for cyber-physical systems design”, DARPA – META2

Alex Grishin PhD, ( 8/07 – 12/10),

“Mesh-free contact analysis for integrated design of assemblies” - unsponsored

Neelakantan Mani , MS, (8/07 -12/2010 )

“Standardization of fitting of CMM algorithms and development of inspection maps”, sponsor: NSF

Adam Dixon, MS (1/08- 5/2010 )

“Assembly feature recognition and intelligent tutor”, sponsor: Army Res Ofc

Jason Fait, MSE, (1/06 - 08)

“Optimal design of Driver golf club”, Karsten (PING)

Ash, Jonathan, MSE (03-10/08)

“Structural optimization of Single Axis Solar Tracker”

M. Murshed, MS (1/05 – 1/08 )

“TechSpec Module for Reverse Engineering”, sponsor: Army Research Office

Harris, Alex, MSE (8/01 -12/06 )

“Manufacturability evaluation of composite parts” – SIMULA

Noe Vargas, Ph.D. (8/98 – 5/07 )  
“A basis for the development of design ideation models based on empirical studies” – sponsor: NSF, FORD

Medichalam, Medhu, MS, (8/01 –5/06 )

“User defined prismatic feature recognition from N-Rep” – sponsor: Army Research Ofc

Shen Zhengshu, Ph.D., (8/00 –10/05)  
“Comparative study of tolerance analysis techniques” – sponsor: NSF

Joshi, Nilesh, MS (8/02 –12/05 )

“Data exchange of user defined features using neutral representation language” – Army Research Ofc

Shiqiao, Li, MS (8/02 –12/05 )

“User defined Feature Recognition of mill-turn parts” - unsponsored

Zhao Zuozhi., Ph.D., (8/00 –5/05 )  
“Development of Theoretical foundations of DfM and Normative Testbed for Manufacturability” – sponsor: NSF

Josh Summers, PhD (8/98 – 5/04 )   
“Investigation of exemplar networks to support embodiment design” – sponsor: NSF

Andy Contes, MS, (1/02 – 12/03)

“Optimal design and manufacturing of a BMX frame” – unsponsored (partial support from bicycle manufacturers)

P. Tharakan, MS, (8/00 – 12/03)  
“Domain independent manufacturing shell with application to machining and injection molding” – sponsor: NSF

Vaidya Adwait, MS, (8/00 –12/03 )  
“Domain independent design shell for parametric design” – sponsor: NSF

Fernando Rangel, MS (1/99 –8/03)  
“Integration of CAD-CAPP using CORBA, Orbix” – GEM scholar/Ford co-op

Wu, Yanyan, Ph.D.(1/99 – 6/02 ) (“Development of math tools for modeling geometric dimensioning & tolerancing” – sponsor NSF

S. Ramaswamy, MS (8/98 –12/00 )  
“Design support system for tolerance specification and verification” – sponsor: NSF

Felicia McCoy, MS (1/98 –12/00 )  
“Statistical evaluation of creativity techniques- human factors” – sponsor: NSF

S. Nandakumar, MS (8/97 – 5/00)  
“Classification, parametrizaion, and recognition of NC features with sculptured surfaces” – Boeing (partial)

V. Subramaniam, MS (8/97 –8/00 )  
“Unified design by features and feature recognition” – NSF

S. Kulkarni, MS (1/97 – 1/00)  
Thesis: “Framework for evaluating conceptual design techniques” – sponsor: NSF-SGER

B. Bettig, Ph.D (1/95- 11/99).   
Dissertation: “A graph based geometric solving system for mech. design problems” – sponsor: NSF-DMI

Dong, G., MSE (8/97 – 12/99)  
Project: “2D Tolerance Stack-up Analysis in a CAD System” – sponsor: NSF

S. Sunderajan, MSE (8/95 – 9/99)  
Thesis: "Implementation of case studies in Design History System"- DARPA

R. D’Souza, MS (1/96 – 12/98 )  
Thesis: “Form feature representation and CAD data transfer” - DARPA

S. Ranagaswamy, MS (1/95 -5/98 )  
Thesis: "Design history capture system" - DARPA

M. Kang, MS (1/96- 8/98 )  
Thesis: “Recognition of 3-axes NC features and process planning” – unsponsored

S. Solkhan, MS (8/95 -12/97 )-  
Thesis: "Generation of automatic feature recognition algorithms from neutral representation" - DARPA

J. Liang, MS (8/95 -12/97 )  
Thesis: "Consolidated data schema for airframe engineering analyses" – Boeing Defense

H. Dedhia, MS (8/94 - 12/97 )  
Thesis: "Interactive feature definition" - EDS, NSF

S. Qureshi, Ph.D. (1/94 -8/97 )  
Dissertation: "Integration framework for design information of electromechanical systems" - sponsor: DARPA

J. Echave, MS (1/95 -5/97)  
Thesis: "Detailed process, fixture, and toolpath planning for generative machining " - Sponsor:Fundychuo Fellowship

P.Bliznakov, Ph.D. (1/92 -12/96 )  
Dissertation: "Design information model to support engineering design process" - sponsor: NSF-CISE

K. Hirode, MS (8/94 - 11/96 )  
Thesis: "Automatic evaluation and iterative refinement of machining process plans" - sponsor: NSF

T. Kraver, Ph.D. (1/90 - 12/95)  
Dissertation: "Development of flat belt power transmission design methodology and analysis techniques”,

- unsponsored (experimental apparatus and facilities provided by Kumm Industries)

Y.Yan, MS (8/93 -9/95 )  
Thesis: "Dimension & Tolerance mapping" - NSF

Y. Shen, Ph.D. (8/91- 9/94 )  
Dissertation: "Design to manufacturing feature mapping based on volume decomposition and half space partitioning” - sponsor: NSF-DMC

D. Toppenberg, MS (8/92- 5/94)  
Thesis: "Design of new type of rotary engine"- NASA Graduate Fellowship

J. Leonard, MS (5/92-5/94 )  
 Thesis: "Automatic workpiece selection for machining"- sponsor: NSF-DMC

A. Ali, MS (1/92- 8/94)  
Thesis: "Declarative approach to form feature definition" - sponsor: USCAR

A. Shirur, MS (8/92- 9/94)  
Thesis: "Automatic generation of machining alternatives for removal volumes"- sponsor: NSF-DMC

D. Syms, MS (8/91- 8/93)  
Thesis: "Feature based design of automotive sheet metal parts" - sponsor: General Motors

V. Pherwani, MS (1/91- 8/93)  
Thesis: "Dynamic binding of features and solid models" - sponsor: NSF-DMC

G. Balakrishnan, MS (8/91- 9/93)  
Thesis: "Constraint based approach to product modeling"- sponsor: NSF-CISE

R.C. Tadepalli, MS (8/88- 8/91)  
Thesis: "Feature based Assembly Modeling" - supported by ASU-IIA

S. Ghosh, MS 1/89- 12/91 )  
Thesis: "An intelligent abstract graphical environment for routine mech. design" - sponsor: Garrett

S. Sen, MS (8/88- 8/91)  
Thesis: "A Knowledge-based development shell for mech. component design" - sponsor: Garrett

Bing-Chun Zhang, Ph.D. (8/89 - 8/92)  
Dissertation: "Geometric Modeling of Dimensioning & Tolerancing" - unsponsored

David Hsiao, Ph.D. (8/87 - 8/90)  
Dissertation: "Feature Mapping and Manufacturability Evaluation" - sponsors: ICI Composites+ CAMI

P. Sreevalsan, MS (1/88- 5/90 )  
Thesis: "An Investigation of the Unification of Form Feature definition methods"-sponsor: CAM-I

Abraham Mathew, MS (1/88- 5/90 )  
Thesis: "An evaluation of the Product Data Exchange Specification (PDES)" - sponsor: CAM-I

Hung Dao, MS (8/87- 12/90 )  
Thesis: "Automating some aspect of conceptual design of structures."- unsponsored

David Miller, MS (8/87-5/89)  
Thesis: "A Structure for supporting geometric tolerances in geometric models"-sponsor: Texas Inst.

Anant Bhatnagar, MS (1/87-6/88)  
Thesis: "Feature Mapping and Geometric Reasoning Shell for GT Coding"- sponsor: GE

Bongee Liou, MS (1/87-8/88)  
Thesis: "Pseudo boundary modeler and feature interface for design by features"- sponsor: Texas Instr.

Mary Rogers, MS (1/86-12/87)  
Thesis: "Design and Implementation of Form Feature Modeling System"- Sponsor: NSF-DMC

Lalit Pandit, MS (8/84-5/86)  
Thesis: "Expert system for conceptual design of load bearing parts"- unsponsored

## 4.2 Dissertations/Theses In Progress

Mahmoud Dinar, PhD (8/10 - )

“P-maps data structures”, sponsor: NSF CreativeIT

Zihan Zhang, PhD (8/2010 - )

“Fractionated satallite adaptability methodology” – DARPA-F6

Yadong Shen, MS (9/10 - )

“Cluster algebra for GDT”, NSF

Maryam Khorshidi, PhD (8/11 - )

“Embedded simulation in design ideation”, NSF

Prabath Velumpalli, MS (5/11 - )

“Transformation of T-maps to m-maps based on manufacturing process sequences”, NSF

Xiang Ke, MS (1/11- )

“ Quantification of product architecture characteristics for adaptability measurements”, DARPA-F6

Sumit Narsale, MS (8/11 - )

“Data mining of ideations paths”, NSF

Prashant Prashant, MS (5/11 - )

“Least Square, one-sided and Tchebyshev function library for GDT verification with CMM”

Valeri Khadarov, MS (8/11 - )

“MATSUB2 enhanced search engine and database” - unsponsored

Haghighi, Payam, MS (8/2010 - )

Syam S. Rao, MS (8/2012 - )

Rahul Purushothaman, MS (8/2012 - )

## 4.3 Other MSE students supervised

G. Dong (Completed – 12/99)

S. Sunderajan (completed – 10/99)

Ken Ziesmer (completed – 9/99)

## 4.4 Co-advisement of Computer Science students

Anish Shah, MSE, completed 2001

“Development of eLANE web based services”

Dae Jeon, Ph.D., in progress; CSE Prof: S. Urban   
"Process model for archiving engineering design histories" - sponsor: NSF-CISE

Xiaomin Li, Ph.D, in progress, CSE Prof. Kamambathi (CSE)  
“Process plan refinement framework based on AI/Planning techniques” - unsponsored

Tijhadi, M: MS, completed, CSE Prof. Urban   
“EXPRESS to ORACLE8 mapping” - DARPA-RaDEO

Raghupathy S, MSE, completed; CSE Prof: S. Urban   
"Integrated data model for ASU Design Systems"- sponsor: Garrett Engines

Batchu, S., completed; CSE Prof: R. Kamambathi  
"Iterative algorithm for interactive planning" - unsponsored

Prasad, Ravi, MSE, completed; CSE Prof: S. Urban  
"Integration architecture for heterogeneous engineering databases"- sponsor: NSF-CISE

Liu, Hong, MS, completed; CSE Prof: S. Urban  
"ITASCA interface tools for dynamic access" - sponsor NSF-CISE

# 5. PATENTS/ COPYRIGHTS/DESIGN ARTIFACTS

1. *Robo-Rover -* Acoustically navigated robotic system for outdoor applications – US Patent#05940346, 1999. (with J. Sadowsky, co-author)
2. *Math model for geometric tolerances –* US Patent# 6,963,824, 2005 (with J. Davidson)
3. *ASU Features Testbed* - Copyright no. TX 3 433 160, Nov 1992, Arizona Board of Regents.

# 6. TEACHING

## 6.1 New Courses Developed & Taught (these are classes I created at ASU)

*MAE598 - Advanced CAE simulation* –advanced applications of FEA: rigid and flexible body dynamics, free & forced vibrations; eigen and non-linear buckling; contact analysis; non-linear structural problems including large displacement, large strains and non-linear materials (graduate level)

*MAE540 - Advanced Product Design* - a required core class for in-coming graduate students planning to get M.S./Ph.D. in Mechanical Design. Includes design methods for conceptual & embodiment design, optimization, robust design, utility & decision theory, benefit-cost analysis, probabilistic design. Students are required to complete a design project, conduct a research study and are assigned to a local company for a design case study.

*MAE598x - Design Geometry & Kinematics –* Reviewof classical Euclidean geometry, affine and projective geometry, screw theory and differential geometry (I developed only the differential & computational geometry portion)

*MAE541* - *CAD Software Development* – Principles of engineering software design, object oriented architectures, data structures, graph and geometric algorithms in C++; introduction to solid modeling using ACIS.

*MAE546 - CAD/CAM Applications* - Graduate / Senior undergraduate- hands on projects in design, analysis and manufacturing simulation using commercial CAD, FEA, NC.

*MAE323 - Computer aided engineering II* – junior level; teaches students FEA modeling using commercial packages such as Ansys or Nastran; focuses on linear static structural analysis

*MAE214 - Computer aided Engineering I* – sophomore level; introduction to geometric modeling in CAD; technical drawings; tolerance specification.)

*MAE442 -* *Mechanical Systems Design* - a senior level tech elective - emphasis on multi disciplinary approach to design synthesis involving electrical, electronic, electro-mechanical, hydraulic, and mechanical components.

## 6.2 Courses Taught (in addition to the above)

*MAE441/342 - Principles of Design* - Undergraduate, junior level, required – mechanical design process and methods

*MAE443 - Capstone Design Project* - senior, required - students work in groups on a single project

*MAE351 - Manufacturing Processes* - junior level - survey of processes; manufacturability

*MAE313 - Mechanics of Materials* - sophomore/junior level - a first course in stress analysis

*ME563 - Design of Machine Elements* (Mech Design III) - senior, required - taught at Ohio State

*ME562 - Structural Design* (Mech Design II)- junior/senior level, required - taught at Ohio State

*ME560 - Materials, Mechanical Behavior and Design* (Mech. Design I) -junior level, required - taught at Ohio State

## 6.3 Short Courses/Workshops Taught

*“Design ideation tools”, workshop Intel ATD (2007) and ETD (2009, Chandler, AZ*

*“Introduction to Geometric Dimensioning & Tolerancing” -* ½ day tutorial at ASME DETC 2001, Pittsburgh and ASME DETC 2002, Montreal, 2005 Long Beach. (also taught at Intel in 2007 and Honeywell in 2005)

*“Feature-based CAD/CAM: Fundamentals & Applications”*

3-day short course for industry offered through ASU Professional Development Center. Lab sessions are based on ASU developed software for design, manufacturing planning, DFM, tolerancing, and GT coding. Total of 22 hours of lectures and labs combined.

*"Research issues in Feature Modeling"-*

Science & Engineering Research Council Workshop, Bristol (UK), Aug 1992. Attended by representatives from 8 British Universities and 5 Companies.

*"Engineering Database Technology - Data Exchange Standards" – a tutorial*

NTU National Tech. University TV satellite network, broadcast from Georgia Tech., May 17, 1991.

*"Solid Modeling Fundamentals" –*

GM Tech Center, Warren, Michigan, Aug 1991 (8 hours)

*"Design of Feature Based Modelers" –*

GM Tech Center, Warren, Michigan, Aug 1991 (12 hours)

*"Features Technology" -*

A 2-day tutorial on parametrics, constraint solving, design by features, feature recognition and feature mapping. Taught at Helsinki Univ Technology, FINLAND, Oct 1991 and again at the Philips Company, HOLLAND, Dec 1991.

## 6.4 Laboratory development

**Research labs**

* *CAE & Expert Systems Lab* - established a new teaching/research laboratory at ASU, with grants from NSF, industrial affiliates, and equipment donations. Administered and operated the lab from 1985-92. The lab housed several Artificial Intelligence workstations (LMI, Xerox, Sperry, TI), several graphics workstations (CV, SGI, Suns), and one Simulation Workstation( E & S). The lab was dismantled in Jan 93.
* *Design Automation Lab* (GWC476, moved to 477): Established originally with the help of an equipment grant from Hewlett-Packard in 1993, upgraded in 1998 with DARPA funds; updated and re-organized in 2002 from funds from various sources (internal & external). The lab is equipped with an array of computer workstations, multi-media equipment, CNC machine, CMM machine, injection molding press, peripherals, and CAD software.

**Instructional labs**

Developed several new instructional laboratories for supporting the design curriculum:

* *CAE Lab (GWC481):* Computer mediated lab for teaching of FEA, Kinematic & Dynamic simulation, Thermal & fluid analysis tools. Made possible by a grant from INTEL.
* *Design Imaginarium (GWC477)*: For exercises related to creativity, lateral thinking, conceptual design, and visual thinking. Funded internally.
* *Design Prototyping Lab (GWC465)*: For building design projects related to class exercises, design contests, and other projects. Workstations for sheet metal, aluminum, wood, plastics, and foam-core are provided.
* *Electro-Mechanical Systems* *Lab(GWC 483)*: Joint lab with EE Dept. for research/teaching in design/analysis of embedded micro-controllers systems. Sponsor: In-kind donations from Motorola SPS and later from NSF.

# 7. SERVICE

## 7.1 National/International

Technical Editor (founding), *ASME Transactions, J. of Computing & Information Science in Engineering*, 2000-10

Area Editor, Automation & informatics, *Research in Engineering Design*, Jan 2011 – to date

International Conference on Research into Design (ICoRD'13), Bangalore, Prog Committee

Program Committee, Design Computing & Cognition DCC12

Program Committee, Solid & Physical Modeling 2012

AAAI Spring Conf on Artificial Intelligence, Program Committee, 2010

Board Member, ECDTR (Electronic Colloquium on Design Research Thinking), 2010 - present

ICED program com & reviewer, 2008-09

CIRP Tol conf, Prog Comm, 2008-09

Co-Chair, IEEE CAD Graphics conference, China, 2009

Editorial Advisory Board, *Computer aided Design,* 2002-2005

Chair, Engineering Design 2030, Strategic Planning Workshop for NSF’s Design Engineering Program, May 2004.

Co-Chair, 2005 NSF Grantees Workshop

Automotive Industry Metrology Consortium, Area Expert GD&T, 2001-02

Program Committee, IFIP Knowledge Intensive CAD conference, Parma, Italy, 1999.

IFIP KIC-3, GEO-6 Tokyo Program Committee, 1998

ICED Munich Program Committee, 1998

Conference Chair, ASME Design Theory & Methodology, Atlanta, 1998.

Technical Program Chair, ASME Design Tech Conference, Sacramento, 1997

Program Committee, MICAD 96, Paris, France, 1996, 1997, 2000

Conference Chairman, NSF Strategic Planning Workshop on Engineering Design, Gold Canyon, AZ, May 1995.

Program Committee, IFIP WG5.2 conference, Helsinki, 1995.

Chairman, ASME-CIE Technical Committee on CAD(1991- 92)  
Chairman, ASME-CIE Technical Committee on AI & Knowledge Based Systems (1989 - 1991)  
ASME Technical Committees on Design Theory and Methodology (1988- ) and Design Automation (1991 - )  
North American Manufacturing Research Institute, 1989  
Associate Program Chairman, ASME Computers in Engineering Conference, Boston, 1990; Santa Clara 1991.

Program Committee, IFIP WG 5.2 Working Conference on Intelligent CAD, 1991  
Organizer and Speaker, SIAM mini-symposium on Mathematical modeling of Tolerances, Nov 1993  
Paper Reviews for ASME CIE, ASME DTM, ASME DAC, ASME WAM conferences, 1986-95  
Paper Reviews for ASME Transactions on Mechanical Design, Transactions on VASR and Design  
Paper Reviews for Computer aided Design Journal (on Review Committee since 1991)  
Paper Reviews for Research in Engineering Design (1989-95)

NSF Proposal Review panels – served on about 20 panels in the past 10 years.

NSF Committee of Visitors to review the DMII program, 1998  
Reviewer for ANSI/ISO Draft STEP international standards on features and tolerances (1988-92)

Reviewer for ISO Draft STEP international standards on parametrics (1998-00)

## 7.2 Department/College/University Service

University Senate, 2007 – 2010

University Senate Personnel Committee, 2009-10

University Senate Web Committee, 2009-10

School By-Laws, 2009

College Senate, 2004-06

Review Committee, College design core classes (ECE100, 300) – 2003

Chairman, Committee on integration of computing tools into ME curriculum

MAE Dept. Executive Committee, 2000-01

Chairman, MAE Graduate Affairs Committee, 1999-01, Member 2002-2005

Senator, Faculty Assembly, ASU, 1995-96, 96-97.

Chair, Promotion & Tenure Committee, MAE Dept., ASU, 1996; member 1995-2006

Member, Promotion & Tenure Committee, MAE Dept., ASU, 1994-03

President, Sigma Xi, Local chapter, 1994-95;

Goldwater Design Labs Co-ordinator, 1993-01

Chairman, Design Search, 1999; Manufacturing faculty search, 1993; IE Dept Chair Search Committee, 1993;

Aerospace Design Curriculum Oversight Committee, 1993-94, 96-97

Business-Engineering Dual Degree committee, 1993; Manufacturing curriculum development committee, 1993

Engineering core curriculum committee, 1993; ME Curriculum Committee, ASU, 1986.  
Graduate Affairs Committee, 1989-91,

Member of Parking Appeals Board at ASU from 8/86 – 91.

## 7.3 Memberships

Fellow, ASME

Member, AIAG Metrology Consortium

Past member, IEEE, SigmaXi, and SME/ NAMRC

Past chapter President, Sigma Xi, ASU

## 7.4 Administrative Service/positions

2009 School re-organization/mergers

2007 – 09 ASU University Senate

2004 – 06 Fulton School senate

2002 – 05 Member, MAE Graduate Committee

2000 – 01 MAE Executive Committee

2000 – 05 Director, Design Engineering & Manufacturing Automation Program (DEMAP)

1999 – 01 Chair, MAE Graduate Affairs Committee

1996 – 97 Chair, MAE Promotion & Tenure Committee

1995 – 97 MAE Graduate Affairs Committee

1995 – 97 ASU senate

1994 – 95 President, Sigma Xi, ASU chapter

1994 -03 Member, Promotion & Tenure Committee, MAE Dept.

1994 – 1996 Project Manager, The Virtual Corporation

1993 – 07 Goldwater Design Labs Co-ordinator

1993 – 95 Business-Engineering Dual Degree committee

1992 – present Director, Design Automation Lab (<http://asudesign.eas.asu.edu>)

1989 – 91 MAE Graduate Affairs Committee

1986 – 91 Co-Director, CAE & Expert Systems Lab

1986 Engineering core curriculum committee

1978 – 80 Production Manager, BOC/POL

# 7.5 Major Professional Events Organization & Management

Chair, NSF-DMII Grantees Research Conference, Scottsdale, Jan 2005 (handled budget of $1.5 million)

Chair, NSF Engineering Design 2030, Strategic Planning Retreat, Gold Canyon, AZ, April 2004

Chair, Army Research Office VPERI conference, Tempe, 2003

Chair, Automotive Industry Action Group, Metrology Annual meeting, 2002

Chair, NSF Engineering Design Planning workshop, 1995