

Compliant and Robotics Systems Laboratory

Faculty Building, #369

Indian Institute of Technology, Kanpur 208016

Tel: 512-259-7397, email: anupams@iitk.ac.in

Formerly,

1. Visiting Associate Professor, IGM, RWTH-Aachen University, Deutschland

Eilfschronstein Straße, 18, 52062 Aachen

Tel: + 80 95552

E:mail: saxena@igm.rwth-aachen.de

2. Visiting Assistant Professor in Mechanical Engineering

222, Upson Hall, Cornell University, Ithaca, NY 14850

**Permanent Residence:**

468, Indian Institute of Technology, Kanpur, 208016

Tel: 512-259-8712

**ACADEMIC PREPARATION**

Ph. D. in Mechanical Engineering

University of Pennsylvania, PA, USA

1997-2000

Advisor: Prof. G. K. Ananthasuresh

Dissertation: **Topology Optimization of Compliant Mechanisms for Flexibility, Stiffness and Strength**

M. S. in Mechanical Engineering

University of Toledo, OH, USA

1995-1997

Advisor: Prof. Steven N. Kramer

Thesis: **A New Pseudo Rigid Body Model for Flexible Beams in Compliant Mechanisms**

B. Tech in Mechanical Engineering

Indian Institute of Technology, Bombay

1991-1995

EXPERIENCE

Visiting Associate Professor, RWTH Aachen, Germany

May, 2012- Dec, 2012

Visiting Associate Professor, RWTH Aachen, Germany

May, 2010- June, 2011

Associate Professor

2008-

Visiting Assistant Professor, Cornell University

July, 2006-June 2007

Assistant Professor, Indian Institute of Technology, Kanpur INDIA 208016

2001-2008

Research Assistant, University of Pennsylvania, PA

1997-2000

Teaching Assistant, Engineering College Computing, University of Toledo, OH

1996-1997

HONORS AND AWARDS

Alexander von Humboldt Fellowship	2010
AICTE Career Award	2006
Procter and Gamble Best Professional Paper Award	1997
Silver Medal, Mathematics Talent Search Examination, Government. of INDIA	1991
VivekVir Award, Government of Madhya Pradesh, INDIA	1992

SERVICE ACTIVITIES

Academic

1. **Associate Editor: Journal of Mechanisms and Robotics**
2. Symposium Coordinator, ASME IDETC 2010, Compliant Mechanisms
3. Session Chair, ASME IDETC 2006 (Compliant Mechanisms), 2009 (Compliant Mechanisms, Robotics)
4. Convener, International Conference on Microactuators and Micromechanisms, MAMM-2012, CSIR-CMERI India, January 19-20, 2012
5. Reviewer: ASME Journal of Mechanical Design, Structural and Multidisciplinary Optimization, Computer Aided Design, International Journal for Numerical Methods in Engineering, Finite Elements in Analysis and Design

Non-academic

Games Counselor, Student Gymkhana	2008-Apr 2009
Secretary, Faculty Club, Indian Institute of Technology, Kanpur	2004-2006
Chairman, Staff Gymkhana, Indian Institute of Technology, Kanpur	2002-2003
Faculty Advisor, Association of Mechanical Engineers, IIT, Kanpur	2002-2003
Faculty Advisor, Association of Mechanical Engineers, IIT, Kanpur	2011-2012

INVITED TALKS (SEMINARS)

1. Cornell University	August, 2006
2. University of SUNY Buffalo	Mar, 2007
3. University of Milwaukee	Sep, 2007
4. IIT KANPUR	Oct, 2009
5. RWTH-Aachen University	Nov, 2010
6. TU Delft	Feb, 2011
7. IIT Bombay	October, 2011
8. RWTH-Aachen University	November, 2012

PUBLICATIONS

Books

- B1. Book: Saxena, A. and Sahay, B., 2005, "Computer Aided Engineering Design," Anamaya Publishers (INDIA) and Springer, PO BOX 322, 3300 AH Dordrecht, The Netherlands
- B2. Book: Saxena, A., 2011, "Implementing Topology Optimization for Stiff and Compliant Continua with Discrete and Continuum Elements," in preparation

Book Chapters

- BC1. Book Chapter: 2003, Chapter 2, "Synthesis for Mechanical Behavior," *with G. K. Ananthasuresh*, in *Optimal Synthesis Methods for MEMS*, Kluwer Academic Publishers, Boston, MA, USA, 2003, pp. 13-42.

Journal (published/accepted/in press; reverse chronological order)

- J30. M. Felix Orlando, Ashish Dutta, Anupam Saxena, Laxmidhar Behera, Tomohiro Shibata, 2012, "Manipulability Analysis of Human Thumb, Index and Middle fingers in Cooperative 3D Rotational Movements," *Robotica*, accepted.
- J29. Saxena, A., Valero-Cuevas, F., J., Lipson, H., 2012, "Functional inference of complex anatomical tendinous networks at a macroscopic scale via sparse experimentation," *PLOS Computational Biology*, 8(11): p.1-17
- J28. Saxena A. and Sauer, R.A, 2012, "On combined Gradient-Stochastic Search for Topology Synthesis using the Material Mask Overlay Method," *International Journal for Numerical Methods in Engineering*, in press. DOI: 10.1002/nme.4401
- J27. Shinde, V. R, Dutta, A., Saxena, A., 2012, "Experiments on multi-agent capture of a moving object using projective path planning," *Robotica*, DOI: 10.1017/S0263574712000239
- J26. Reddy, BVS Nagendra, Sujitkumar V. Naik and Saxena, A., 2012, "Systematic Synthesis of Large Displacement Contact Aided Monolithic Compliant Mechanisms," *ASME Journal of Mechanical Design*, 134(1), pp.011007-1-12
- J25. Saxena, A., 2011, "Topology Optimization with Negative Masks using Gradient Search," *Structural and Multidisciplinary Optimization*, 44 (5), pp. 629-649
- J24. Sujit KVN, Saxena, A., Rai, A., Reddy, BVS Nagendra, 2010, "How to Choose from a Synthesized Set of Path- Generating Mechanisms," *ASME Journal of Mechanical Design*, accepted
- J23. Saxena, A., 2011, "Kempe's Linkages and the Universality Theorem," *Resonance*, 16 (3), pp. 220-237, DOI:10.1007/s12045-011-0028-x.
- J22. Saxena, A., 2011, "An Adaptive Material Mask Overlay Method: Modifications and Investigations on Binary, Well Connected Robust Compliant Continua," *ASME Journal of Mechanical Design*, 133 (4), pp. 041004-1-11
- J21. Saxena, A., 2011, "Are Circular Shaped masks Adequate in Adaptive Mask Overlay Topology Synthesis Method," *ASME Journal of Mechanical Design*, 133(1), pp. 011001-1-11.
- J20. Mannepilli, S., Dutta, A., Saxena, A., 2010, "A multi-objective GA based algorithm for 2D form and force closure grasp of prismatic objects," *International Journal of Robotics and Automation*, 25 (2), DOI: 10.2316/Journal.206.2010.2.206-3359
- J19. Khan, H., Sinha, P., Saxena, A., 2009, "A Simple Algorithm for ThermoElastohydrodynamic Lubrication Problems," *International Journal of Research and Reviews in Applied Sciences*, Volume 1, Issue 3 (December, 2009), 265-279.
- J18. Rai, A.K., Saxena, A., Mankame, N. D., 2010, "Unified synthesis of compact planar path-generating linkages with rigid and deformable members," *Structural and Multidisciplinary Optimization*, 41:863-879.
- J17. Jain, C. and Saxena, A., 2009, "An Improved Material-mask overlay strategy for Topology Optimization of Structures and Compliant Mechanisms," *ASME Journal of Mechanical Design*, 132 (6), DOI: 10.1115/1.4001530.
- J16. Saxena, R. and Saxena, A., 2009, "Design of Electro-Thermally Compliant MEMS with Hexagonal Cells using Local Temperature and Stress Constraints," *ASME Journal of Mechanical Design*, Volume 131, Issue 5, 051006 (10 pages), doi:10.1115/1.3087544
- J15. Saxena, A., 2008, "A Material-Mask Overlay Strategy for Continuum Topology Optimization of Compliant Mechanisms using Honeycomb Discretization," *ASME Journal of Mechanical Design*, Volume 130, Issue 8, 082304 (9 pages) doi:10.1115/1.2936891
- J14. Saxena, R. and Saxena, A., 2007, "On Honeycomb Representation and SIGMOID Material Assignment in Optimal Topology Synthesis of Compliant Mechanisms, Finite Elements in Analysis and Design, Volume 43 , Issue 14, Pages: 1082-1098

- J13. Sharma, P., Saxena, A., and Dutta, A., 2008, Optimal Arrest and Guidance of a Moving Prismatic Object using Multi-Agents; *Robotica*, Volume 26, Issue 1, pp - 41-53
- J12. Valero-Cuevas, F. J., Anand, V., Saxena, A., Lipson, H., 2007, Beyond parameter estimation: Extending biomechanical modeling by the explicit exploration of model topology, *IEEE Transactions of Biomedical Engineering*, Nov;54(11):1951-64.
- J11. Srivastava, M., Dutta, A., Saxena, A., 2007, Trajectory generation using GA for an 8 DOF biped robot with deformation at the sole of the foot, *Journal of Intelligent and Robotic Systems*, 49, pp 67-84
- J10. Rai, A. K., Saxena, A., Mankame, N. D., 2007, Synthesis of Path Generating Compliant Mechanisms using Initially Curved Frame Elements, *ASME Journal of Mechanical Design*, Vol. 129, pp, 1056-1063
- J9. Tuli, M., Reddy, N.V., Saxena, A., 2006, Constrained Shape Modification of B-Spline curves, *Computer-Aided Design and Applications*, Vol. 3, N (1-4), pp 437-446.
- J8. Bansal, S. K., Malik, P., Saxena, A. and Reddy, N. V., 2008, Modular Fixture Planning for Minimum Three-dimensional Tolerances, *International Journal of Production Research*, Volume 46, Issue 6 March 2008, pages 1455 - 1476
- J7. Saxena, A., 2005, Topology Design of Large Displacement Compliant Mechanisms with Multiple Materials and Multiple Output Ports, *Structural and Multidisciplinary Optimization*, Vol. 30 (6), pp. 477-490.
- J6. Saxena, A., 2005, Synthesis of Compliant Mechanisms for Path Generation using Genetic Algorithm, *ASME Journal of Mechanical Design*, Vol. 127, July 2005, pp 1-8.
- J5. Saxena, A. and Ananthasuresh, G. K., 2003, A Computational Approach to the Number Synthesis of Linkages, *ASME Journal of Mechanical Design*, Vol. 125, pp 1-10.
- J4. Saxena, A. and Ananthasuresh, G. K., 2001, Topology Design of Compliant Mechanisms with Strength Considerations, *Mechanics of Structures and Machines*, 29(2), pp. 199-221
- J3. Saxena, A. and Ananthasuresh, G. K., 2001, Topology Synthesis of Compliant Mechanisms for Nonlinear Force-Deflection and Curved Output Path, *ASME Journal of Mechanical Design*, March 2001, Vol. 123, pp 33-42.
- J2. Saxena, A. and Ananthasuresh, G. K., 2000, On an Optimality Property of Compliant Topologies, *Structural and Multidisciplinary Optimization*, 19 (1), pp. 36-49.
- J1. Saxena, A. and Kramer, S. N., 1998, A Simple and Accurate Method for Determining Large Deflections in Compliant Mechanisms subjected to End Forces and Moments, *ASME Journal of Mechanical Design*, 120(3), pp. 392-400.

Journal (Communicated/in revision/preparation; reverse chronological order)

- J37. Kumar, P. and Saxena, A., 2012, "Embedded Boundary Smoothing in Topology Optimization with Hexagonal Tessellation and Negative Masks," in preparation
- J36. Goswami, M., Saxena, A. and Munshi, P, 2012, A new grid based tomographic method for two-phase flow measurements, *Nuclear Science and Engineering*, revised.
- J35. Goswami, M., Saxena, A. and Munshi, P, 2012, "On Optimal, Efficient and Reliable Reconstruction from LVT Data using the PI grid," submitted
- J34. M. Felix Orlando, Ashish Dutta, Anupam Saxena, Laxmidhar Behera, Tomohiro Shibata, 2012, "On Redundancy Resolution of the Human Thumb, Index and Middle Fingers in Cooperative Object Translation," in preparation.
- J33. Saxena, A., 2012, "Contact-Aided Compliant Displacement-Delimited Gripper Manipulators," *ASME Journal of Mechanisms and Robotics*, revised.
- J32. Mankame N. D., and Saxena A., 2010, "Analysis of the Hex Cell Discretization for Topology Synthesis of Compliant Mechanisms," in preparation

- J31. Saxena, A. and Mankame, N. D., 2010, "On Distributivity in unambiguously interpretable monolithic compliant continua," in preparation.

Refereed Conferences

- C46. Orlando, F. M., Dutta, M., Saxena, A., Behera, L., Shibata, T., and Tamei, T., 2011, "Design and development of a three finger hand exoskeleton," The 29th Annual Conference of the Robotics Society of Japan, Shibaura, September 7-9.
- C45. Goswami, M., Saxena, A., Munshi, P., 2011, "Void Fraction Measurement Using Entropy Maximization Approach," Transactions of the American Nuclear Society, Vol. 104, Hollywood, Florida, June 26–30, 2011, pp. 1094-1095.
- C44. Sharma, P. and Saxena, A., 2011, "On Binary Topology Design for Electro-Thermally-Compliant MEMS," Mechanisms and Machine Science, Springer, ISSN: 2211-0984. Workshop on Machines and Micromechanisms, MAMM 2010, May 26-28, Aachen, Germany.
- C43. Orlando, F. M., Dutta, A., Behera, L., Saxena, A., 2010, "Optimal design and control of a thumb exoskeleton," IEEE, TENCON, Nov, 21-24, Fukuoka, Japan, #5627.
- C42., Reddy, BVS Nagendra, Saxena, A., 2010, "Automated Design Of Contact-aided Compliant Mechanisms Using Initially Curved Frame Elements," ASME Design Engineering and Technical Conferences, Montre'al, Canada, Aug 15th – 18th, 2009, #DETC-29172.
- C41. Naik, S., Saxena, A., Rai, A. K., 2010, "On criteria for choice of the best solution from a generated set of partially compliant linkages," ASME Design Engineering and Technical Conferences, Montre'al, Canada, Aug 15th – 18th, 2009, #DETC-29137.
- C40. Saxena, A., 2010, "On an Adaptive Mask Overlay Topology Synthesis Method," ASME Design Engineering and Technical Conferences, Montre'al, Canada, Aug 15th – 18th, 2009, #DETC-29113.
- C39. Sharma, P., Saxena, A., 2010, "On Evaluation of Adaptive Mask Overlay Topology Synthesis Method using Different Mask Shapes," ASME Design Engineering and Technical Conferences, Montre'al, Canada, Aug 15th – 18th, 2009, #DETC-29019.
- C38. Akolkar, A., Orlando, M. F., Dutta, A., Saxena, A., Behera, L., 2009, "Optimal design and control of a hand exoskeleton for rehabilitation of stroke patients," ICROS-SICE International Joint Conference, Fukuoka International Congress Center, Fukuoka, JAPAN, August 18(Tue.)-21(Fri.), 2009 (submitted)
- C37. Shinde, V. S., Saxena, A., Dutta, A., Panda, B. Maji, T., 2009, "Experimental evaluation of multi agent based optimal arrest and guidance of a prismatic 2D object avoiding obstacles," ICROS-SICE International Joint Conference, Fukuoka International Congress Center, Fukuoka, JAPAN, August 18(Tue.)-21(Fri.), 2009 (submitted)
- C36. Mankame, N. D., Browne, A. L., Saxena, A., 2009, "Shape memory polymer based reconfigurable compliant mechanisms: an exploration," ASME Design Engineering and Technical Conferences, San Diego, CA Aug 30th – Sep 2nd, 2009, #DETC- 87331.
- C35. Jain, C., and Saxena, A., 2009, "On an adaptive Material-mask overlay strategy for Topology Optimization of Structures and Compliant Mechanisms," ASME Design Engineering and Technical Conferences, San Diego, CA Aug 30th – Sep 2nd, 2009, #DETC- 86712.
- C34. Singh, S. P., Dutta, A., Saxena, A., 2009, "Design of a biped robot with torsion springs at the joints for reduced energy consumption during walk," ASME Design Engineering and Technical Conferences, San Diego, CA Aug 30th – Sep 2nd, 2009, #DETC-86595.
- C33. Rai, A., Saxena, A., Mankame, N. D., 2009, "Unified synthesis of compact planar path-generating linkages with rigid and deformable members," ASME Design Engineering and Technical Conferences, San Diego, CA Aug 30th – Sep 2nd, 2009, #DETC-86850.
- C32. Khan, H., Sinha, P., Saxena, A., 2008, "A Simple Numerical Method for the Solution of Thermal Elastohydrodynamic Lubrication Problem of Infinite Line Contacts, International Conference on Recent Trends in Computational Partial Differential Equations, ICCPDE-2008, Dec. 10-13, IIT

Bombay.

- C31. Singh, S. P., Dutta, A., Saxena, A., 2008, "Multi agent based optimal arrest and guidance of a prismatic 2D object avoiding obstacles", INDICON: IEEE Conference & Exhibition on Control, Communication and Automation, #172
- C30. Stephen L. Canfield, Daniel L. Chlarson, Alexander Shibakov, Joseph D. Richardson, Anupam Saxena, 2008, "Towards Uniformly Distributed Compliance In Compliant Mechanisms: A Multi-Objective Approach," *ASME Design Engineering Technical Conferences*, Las Vegas, Sep. 2007, paper #. DETC2008-49939.
- C29. Rai, A., and Saxena, A., 2007, "Optimal Continuum Synthesis of Partially Compliant Mechanisms for Prescribed Non-smooth Paths," National Conference on Machines and Mechanisms, IISc, Bengaluru (Bangalore), 12-14th December, *NaComm*- #69.
- C28. Dutta, A., Saxena, A., and Sharma, P., 2007, "Obstacle Avoidance, Arrest And Guidance Of A Prismatic 2D Object Using Multi Agents," International Conference on Instrumentation, Control and Information Technology (SICE2007), Kagawa University, Takamatsu, Japan, September 17-20, 2007. paper #657.
- C27. Saxena, A., Lipson, H. and Valero-Cuevas, F., 2007, "Blind Inference of Tendon Networks Through Minimal Testing," American Society of Bio-Mechanics Meeting, Stanford University, August 22-25, 2007.
- C26. Saxena, A. and Mankame, N., 2007, "Design for Manufacture of Optimal Compliant Topologies with Honeycomb Continuum Representation," IEEE Congress on Evolutionary Computation September-25-28, Swissotel The Stamford, Singapore. submitted
- C25. Canfield, S., Chlarson, D., Shibakov, A., Richardson, J. and Saxena, A., 2007, "Multi-Objective Optimization Of Compliant Mechanisms Including Failure Theories, *ASME Design Engineering Technical Conferences*, Las Vegas, Sep. 2007, paper #. DETC2007-35618
- C24. Mankame, N. and Saxena, A., 2007, "Analysis of the Hex-cell parameterization for Topology synthesis of Compliant Mechanisms," *ASME Design Engineering Technical Conferences*, Las Vegas, Sep. 2007, paper #. DETC2007-35244.
- C23. Saxena, A., 2007, "A Material-Mask Overlay Strategy for Continuum Topology Optimization of Compliant Mechanisms using Honeycomb Discretization," *ASME Design Engineering Technical Conferences*, Las Vegas, Sep. 2007, paper #. DETC2007-34341.
- C22. Sharma, P, Dutta, A, Saxena, A., 2006, "Determination of Optimal Contact Points for Constraining a Prismatic Object by a Group of Mobile Robots," IEEE Conferences on Cybernetics & Intelligent Systems (CIS) and Robotics, Automation & Mechatronics (RAM), Bangkok, Thailand, 7-9 June 2006. Paper # P0474
- C21. Sharma, P, Saxena, A., Dutta, A, 2006, "Multi-Agent Form Closure Capture of a Generic 2d Polygonal Object," *ASME Design Engineering Technical Conferences*, Philadelphia, PA, Sep. 10-13, 2006, paper #. DETC2006-99335.
- C20. Rai, A., Saxena, A., Mankame, N., Upadhyay, CS, 2006, "On Optimal Design Of Compliant Mechanisms For Specified Nonlinear Path Using Curved Frame Elements And Genetic Algorithm," *ASME Design Engineering Technical Conferences*, Philadelphia, PA, Sep. 10-13, 2006, paper #. DETC2006-99298.
- C19. Mishra, A., and Saxena, A., 2005, "On Preliminaries of 3d Solid Reconstruction Using Auxiliary Views," *ASME Design Engineering Technical Conferences*, Design Automation Conference, Long Beach, CA, Sept. 24-Sept 28, 2005, paper # DETC2005-84230.
- C18. Bansal S, Reddy N. V., Saxena A, 2005, "Automated Modular Fixture Planning," Keynote Paper, Computer-Aided Production Engineering, University of Monash, Melbourne, Australia - 21-24 November
- C17. Saxena, R. and Saxena, A., 2003, "On Design of Electro-Thermally Compliant MEMS for Strength," *ASME Design Engineering Technical Conferences*, Design Automation Conference, Chicago, IL, Sep. 2-Sept. 6, 2003, paper #. DETC2002/DAC-48807.

- C16. Saxena, R. and Saxena, A., 2003, "On Honeycomb Parameterization for Topology Optimization of Compliant Mechanisms," *ASME Design Engineering Technical Conferences*, Design Automation Conference, Chicago, IL, Sep. 2-Sept. 6, 2003, paper #. DETC2002/DAC-48806.
- C15. Urankar, S., Singh, A., Jain, P., Saxena, A. and Dasgupta, B., 2003, "Robosloth-A rope climbing robot," *NaCOMM*, National Conference on Machines and Mechanisms, IIT, Delhi, Dec, 2003.
- C14. Saxena, A., Luzhong, Yin and Ananthasuresh, G. K., 2002, "PennSyn 2.0-Enhancements to a Synthesis Software for Compliant Mechanisms," *ASME Design Engineering Technical Conferences*, Design Automation Conference, Montreal, CA, Sep. 29-Oct. 2, 2002, paper #. DETC2002/MECH-34210.
- C13. Saxena, A., 2002, "On Multiple-Material Optimal Compliant Topologies: Discrete Variable Parameterization using Genetic Algorithm," *ASME Design Engineering Technical Conferences*, Design Automation Conference, Montreal, CA, Sep. 29-Oct. 2, 2002, paper #. DETC2002/MECH-34209.
- C12. Saxena, A., Yin, L., Mankame, N., Zhonyang, Q., and Ananthasuresh, G. K., 2002, "Alternate Modeling and Design Parameterization for the Topology Design of Compliant Mechanisms," *39th Annual Technical Meeting, Society of Engineering Science*, October 13-16th, 2002, University Park, PA
- C11. Saxena, A. and Ananthasuresh, G.K., 2001, "On the Extraction of Kinematic Behavior from Optimal Compliant Topologies with Application to Number Synthesis of Linkages," CD-ROM Proc. of 2001 *ASME Design Engineering Technical Conferences*, Design Automation Conference, Pittsburgh, PA, Sep. 9-11, 2001, paper #. DETC2001/DAC-21017.
- C10. Saxena, A. and Ananthasuresh, G.K., 2001, "On Strength Issues in Topology Design of Compliant Mechanisms," CD-ROM Proc. of 2001 *ASME Design Engineering Technical Conferences*, Design Automation Conference, Pittsburgh, PA, Sep. 9-11, 2001, paper #. DETC2001/DAC-21016.
- C9. Saxena, A., 2001, "Topology Synthesis of Compliant Mechanisms with Discrete Design Parameterization," *NaCOMM*, National Conference on Machines and Mechanisms, IIT, Kharagpur, Dec. 21-23, 2001.
- C8. Saxena, A., 2001, "In Pursuit of Global Optimal Compliant Topologies," *NaCOMM*, National Conference on Machines and Mechanisms, IIT, Kharagpur, Dec. 21-23, 2001
- C7. Saxena, A. Wang, X. and G. K. Ananthasuresh, 2000, "PennSyn – A Topology Synthesis Software for Compliant Mechanisms," DETC/MECH-14139, ASME Design Engineering and Technical Conference, Sept. 2000, Baltimore, MD.
- C6. Saxena, A. and Ananthasuresh, G. K., 1999, "Towards the Design of Compliant Continuum Topologies with Geometric Nonlinearity," DETC/DAC-8578, ASME Design Engineering Technical Conferences, Sept. 12-15, Las Vegas, NV.
- C5. Saxena, A. and G. K. Ananthasuresh, 1999, "Path Generation with Compliant Mechanisms using Geometrically Nonlinear Continuum Models," The Sixth National Applied Mechanical and Robotics (AMR) Conference, October, Cincinnati, OH.
- C4. Saxena, A. and Kramer, S. N., 1998, "A Simple and Accurate Method for Determining Large Deflections in Compliant Mechanisms subjected to End Forces and Moments," DETC98/MECH-5883, 25 Biennial Mechanisms ASME Conf., June 13-16, Atlanta, GA.
- C3. Saxena, A. and Ananthasuresh, G. K., 1998, "Topology Synthesis of Compliant Mechanisms using the Optimality Criteria Method," AIAA98-4953, 7th AIAA/USAF/NASA/ISSMO Symposium on Multidisciplinary Analysis & Optimization, Sept. 2-4, 1998/ St. Louis, MO.
- C2. Saxena, A. and Ananthasuresh, G. K., 1998, "Towards an Optimality Criteria Method for Topology Synthesis of Compliant Mechanisms," DETC98/MECH-5937, 25 Biennial Mechanisms ASME Conf., June 13-16, Atlanta, GA.
- C1. Saxena, A. and Kramer, S. N., 1997, "Determination of Large Deflections in Compliant Mechanisms subjected to Combined End Loads," AMR-23, The Fifth National Applied Mechanical and Robotics Conference (**Recipient of the Procter and Gamble Best Professional Paper Award**).

Internal Reports

- I1. Mishra, A. and Saxena, A., 2009, "Reconstruction of 3-D Solids from 2-D Multiple and Primary Auxiliary Views," CARS-1.

RESEARCH SUPERVISION

Ph. D. (ongoing)

- P4. Kumar, Prabhat On Exploring topology design of large deformation continua with negative masks
P3. Orlando, Felix On Design of a Three finger Exoskeleton: Co-supervisors: Ashish Dutta and Laxmidhar Behra
P2. Mayank Goswami on Tomography reconstruction techniques. Co-supervisor: Prabhat Munshi

Ph. D. (Graduated)

- P1. Khan, A Numerical Study of Thermo-Elastohydrodynamic Lubrication of Infinite Line Contact Rough Surfaces. Co-supervisor: Prawal Sinha

Masters Thesis

Ongoing students

None at present.

Past Theses

- T18. Design and Control of Multi-Agents for Transportation of Object in Extended 2D Terrain with Sharad Singhania. Co-supervisor: Ashish Dutta 2011
T17. Optimal Design and Control of Leg Exoskeleton with Ved Prakash Chowdhary 2011
Co-supervisor: Ashish Dutta
T16. Topology optimization of Electrothermally Compliant MEMS using a hybrid approach with Pranay Sharma 2011
T15. How to Choose from a Synthesized set of Mechanisms, with Sujit Kumar V. Naik 2010
T14. Synthesis of Non-smooth path generating Fully Compliant Mechanisms using Self Contact, with Nagendra Reddy 2010
T13. Electric Pulse Aided Single Point Incremental Forming with Amit Srivastava 2010
. Co-supervisors: N. V. Reddy
T12. On Tomography using Finite Element like field approximations and Optimization With Mayank Goswami. Co-supervisors: P. Munshi and M. S. Kalra 2009
T11. Experimental Validation of Form Closure Capture and Transportation of Moving Objects using Projective Path Planning with Vijaysingh R. Shinde. Co-supervisor: Ashish Dutta 2009
T10. An Adaptive Material-Mask Overlay Strategy for Topology Optimization of Compliant Mechanisms with Pavan Kumar 2009
T9. Topology, Shape and Size Optimization of Compliant Mechanisms Using Curved Frame Elements and Genetic Algorithm, with Ashok Rai 2006
T8. Arrest and Guidance of a Moving Object using Multi-Agents, with Pankaj Sharma Co-supervisor: Ashish Dutta 2006
T7. Nonlinear, Transient, Thermo-Elastic Analysis for Continua under High Temperature Environment, with CP Mishra 2006
T6. Local Shape Modification of B-Spline Curves with Mukul Tuli, Co-supervisor N. Venkat Reddy 2006
T5. A Hybrid Approach to Reconstruct 3d Solids From 2d Near Isometric Sketches

withAnjulBeohar, Co-supervisor: AshishDutta	2005
T4. Mathematical Analysis, Design, Development and Experimentation of an 8 DOF Biped Robot with MaitraySrivastava, Co-supervisor: AshishDutta	2005
T3. Automated Design of Modular Fixtures to minimize Tolerances with Prince Malik, Co-supervisor: N. Venkat Reddy	2004
T2. A Novel Parameterization for Topology Design of ETC MEMS for Strength, WithRajatSaxena	2003
T1. Splines based Assessment of Pre and Post Treatments of Dental Fixtures, WithGaurav Seth	2002

Senior Design Projects

SDP1. Design, Fabrication and Control of a <i>Robo-sloth</i> , a rope climbing Robot WithSandeepUrankar, Pranjal Jain, Anurag Singh	2003
SDP2. Design and Fabrication of a Customized Above Knee Prosthesis with Manish Dwivedi, AshishSethi, AmitPahwa, A. P. Singh	2002
SDP3. Design, Fabrication and Control of a <i>Fourdof</i> Redundant Planar Manipulator WithAshishAsthana, NandeeshShukla, Bharat Panjwani, Co-supervisor: SusmitSen	2002
SDP4. <i>Adonis</i> : Walking Machine and Biped WithAbhudyai Singh, ApratimRajendra, Bipin Kumar (Adjudged the best B. Tech project in 2002) Co-supervisor: SusmitSen	2002

Special Projects

SP1. Solid Reconstruction from 2D Engineering Drawings containing primary auxiliary views With Amitesh Mishra, IIT Mumbai	2004
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TEACHING EXPERIENCE

- CO1. ME751 Computer Aided Engineering Design, 2001(II), 2002(I), 2003(I), 2004(I), 2005(I), 2006(I), 2007(II), 2009(I), 2010(I), 2012 (I)
Transformations and Projections, Design and Representation of Curves and Surfaces (Ferguson, Bezier and B-Spline), and Solids (Wire frame, B-rep, CSG and Voxel approaches), Implementation of FEM and Optimization
- CO2. ME 685, Programming and Numerical Methods, 2002(II), 2004(II), 2007 (I)
Curve interpolation and approximation, Numerical integration and differentiation, Single and Multiple Root determination, Solution of linear and nonlinear system of equations, Matrices, and ODE and PDEs
- CO3. ME 681, Mathematical Methods in Engineering, 2005(II)
Vector and Matrix Algebra, Vector Spaces, Ordinary and Partial Differential Equations, Analysis with Complex Numbers
- CO4. ESO204, Mechanics of Solids, Summer, 2003
Stresses, strains, material properties, shear force and bending moment diagrams, deflections of beams, torsion, columns, springs and failure theories
- CO5. ME 351n, Design of Machine Elements, 2003 (II), 2009(II)
Review of Mechanics of Solids, Failure theories, Fatigue failure, Design of fasteners, springs, shafts, spur and helical gears, clutches, brakes and flywheels
- CO6. ME321n, Advance Mechanics of Solids, 2008(I), 2009(II)
Classical Elasticity {Equilibrium equations, strain-displacement relations, compatibility and stress-strain relations, Stress function, Solutions with stress functions}, Tensors, Analysis of Stress and Strain Tensors, Constitutive Elasticity Tensor, Stress-Strain energy conjugate measures, introduction to FEM
- CO7. TA101n, Engineering Drawing and Graphics, 2013 (I)
Orthographic (Third and first angle), Isometric, Sectional, Assembly, Oblique, Perspective and

Auxiliary views, Lines and lanes, Intersection and Development.

SPONSORED PROJECTS

Topology Design of Compliant MEMS for Path Generation, (US\$ 29, 333/ INR Rs. 13, 20, 000)	
Department of Science & Technology,	2006
Design for Optimal Failure-free MEMS Topologies, (US\$ 22, 222/INR Rs. 10, 00, 000)	
Ministry of Human Resources and Development	2003
Topology Design of Compliant Mechanisms with Nonlinear Deformation, (US\$ 6933/INR Rs. 3, 12, 000)	
Department of Science & Technology,	2003
Development of Topology Design Software for Compliant Mechanisms, (US\$ 1111/ INR Rs. 50, 000)	
IIT Kanpur	2001