

## CURRICULUM VITAE

Robert L. Norton P.E.

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774-244-1248

<b>Education:</b>	<i>M.S. Engineering Design</i> Tufts University	1970
	<i>B.S. Industrial Technology (summa cum laude)</i> Northeastern University	1967
	<i>A.S. Mechanical Engineering (cum laude)</i> Northeastern University	1962
<b>Registration:</b>	<i>Registered Professional Engineer</i> Massachusetts – Certificate #28657	1971 - present
<b>Present Positions:</b>	<i>Milton P. Higgins II Distinguished Professor Emeritus</i> Worcester Polytechnic Institute	2012 - present
	<i>President, Norton Associates LLC</i> Naples, FL	1971 - present
<b>Prior Positions:</b>	<i>Milton P. Higgins II Distinguished Professor of Mechanical Engineering</i> Worcester Polytechnic Institute	1981 - 2012
	<i>Senior Engineer, Polaroid Corporation</i> Waltham, Massachusetts	1979 - 1981
	<i>Assistant Professor of Engineering Design</i> Tufts University, Medford, Mass.	1974 - 1979
	<i>Instructor, Department of Surgery</i> Tufts University, Boston, Mass.	1970 - 1982
	<i>Lecturer, Bio-medical Engineering</i> Franklin Institute, Boston, Mass.	1973 - 1976
	<i>Research Associate, Tufts Surgical Service</i> Boston City Hospital, Boston, Mass.	1971 - 1974
	<i>Bio-medical Engineer, Tufts Surgical Research Dept.</i> N.E. Medical Center Hospitals Boston, Mass.	1969 - 1971
	<i>Project Engineer, Jet Spray Cooler Inc.,</i> Waltham, Mass.	1966 - 1969
	<i>Product Design Draftsman/Engineer, Polaroid Corporation</i> Cambridge, Mass.	1959 - 1966
<b>Awards:</b>	Am. Soc. Training and Development (ASTD) Highest Honors Award - 1967 Sigma Epsilon Rho Honor Society - 1967 J. F. Lincoln Foundation Competition Award - 1969 John A. Curtis Outstanding Paper Award, ASEE Annual Conference 1984 Procter & Gamble Best Paper Award, Applied Mechanisms Conference - 1985	

Merle Miller Award for Best Journal Article in 1986, and 1992. ASEE CoEd Journal.  
 Elected a Fellow of the American Society of Mechanical Engineers, 1997.  
 Who's Who in America, Who's Who in Science and Engineering, Who's Who in Engineering Education, Who's Who in the World, and others, 1990-2012.  
 ASME Machine Design Award, 2002.  
 Archie Higdon Distinguished Educator Award, ASEE Mechanics Division, 2004  
 WPI Board of Trustees Award for Outstanding Teaching, 2005  
 U. S. Professor of the Year, C.A.S.E./Carnegie Foundation 2007  
 Outstanding Career Achievement Award, Tufts University Graduate School of Arts and Sciences, 2009.  
 Doctor of Engineering (honoris causa), Worcester Polytechnic Institute, 2012

**Member:** Fellow of the American Society of Mechanical Engineers (ASME)  
 American Society of Engineering Education (ASEE)  
 Society of Automotive Engineers (SAE)

**Reviewer:** ASME *Journal of Mechanical Design*  
 ASME *Applied Mechanics Reviews*  
 IFTOMM Journal, *Mechanism and Machine Theory*

**Patents:**

#3,153,195	R. F. Transmitter
#3,426,664	Self Developing Camera
#3,430,547	Photographic Shutter Mechanism
#3,443,500	Photographic Film Magazine
#3,503,541	Multi-Beverage Dispenser
#3,539,081	Valve-Beverage Dispenser
#3,568,887	Hot Beverage Dispenser
#3,575,536	Pumps-Beverage Dispenser
#3,582,096	Sealing Device-Beverage Dispenser
#3,591,055	Mixing Valve
#3,865,102	External Cardiac Assist Apparatus
#3,878,839	Cardiac Assist Apparatus
#3,964,139	Syringe Holder

**Funded Research:**

1. *Investigation of Cam Manufacturing Technique on Dynamic Performance*  
 National Science Foundation Grant #MEA-8210865. 2 years 1983-85 \$80,000. (approx.)
2. *Cam Dynamics Studies* Supported by AMP Inc. Harrisburg, PA  
 1 year 1984 \$56,000  
 1 year 1986 \$15,000  
 1 year 1988 \$25,000
3. *An Experimental Investigation of the Effects of Run-In Wear in the Dynamic Performance of Cams*  
 National Science Foundation Grant #MSM-8512913. 2 years 1985-87 \$248,000
4. *Unfolding of 3-D CAD Geometries using Cadkey* (with J. Sullivan)  
 Supported by Cadkey Corp. 3 years 1990-93 \$137,000 - Cadkey Corp.
5. *Experimental Investigation of Phase Error Due to Nonlinear Forced Vibrations of Synchronous Belts.*  
 Supported by the Gillette Co., 1998, \$16,000.
6. *Valve Train Vibration Analysis*, Supported by the DaimlerChrysler Co., 2000-2001, \$28,000.
7. Support of four to six MQPs and Masters Theses plus one senior design course (combined) per year from The Gillette Company, Boston, MA at the rate of \$30,000 per year from 2001 to present.

**Equipment Grants Obtained:**

1. AMP Inc., Grant of (1) HP 5423A Structural Dynamics Analyzer for use in cam dynamics research (1984) \$45,000. (approx.)
2. AT&T Inc., Grant of (3) 3B2/400 Super Microcomputers to WPI for use in computational mechanics (1986) \$130,000. (approx.)

3. Hewlett Packard Corp., Grant of (1) HP 350 CAD/CAM System for use in instruction and research (1987) (\$140,000. (approx.)
4. Hewlett Packard Corp., Grant of (1) HP 35660A Dynamic Signal Analyzer (1989) (\$15,500).
5. Hewlett Packard Corp., Grant of (2) HP 35665A Dynamic Signal Analyzers (1993) (\$44,100).

#### **Engineering Society Activities:**

Program Chairman, ASEE Computers in Education Division (CoEd) 1985-86  
 Secretary - Treasurer ASEE CoEd Division 86-87  
 President - ASEE CoED Division 88-90

#### **Masters Theses Advised:**

1983	Holly K. Ault	<i>Evaluation of Sculptured Surfaces for CAD/CAM.</i>
1984	Stephen A. Douglas	<i>Stress Analysis of a Split Circular Ring with Finite Element Methods.</i>
1985	Donald A. Jacques	<i>Effects of Cam Follower Arm Design on Dynamic Performance.</i>
1986	Angelo Villani	<i>Design of a Low Cost Automated Tomato Harvester.</i>
1986	Robert Bean	<i>Closed Loop Controlled Robotic End Effector.</i>
1987	James Wilbur	<i>Experimental and Theoretical Modeling of Dynamic Behavior of a Cam.</i>
1987	Ann E. Pettit	<i>An Analytical and Experimental Investigation of Cam Shaft Vibration.</i>
1987	David Levasseur	<i>Dynamic Performance of Plate Cams as Related to Circumferential Profile Errors.</i>
1988	Michael Savage	<i>Measuring Laryngeal Function by Deconvolution of Vocal Tract Formants.</i>
1989	John E. Titus	<i>The Determination of Isomorphism of Basic Kinematic Chains Utilizing Rook Polynomials.</i>
1989	Robert Bernstein	<i>Investigation of a Transfer Function of the Human Throat to Improve Electrolaryngeal Speech.</i>
1994	Joel Karsburg	<i>The Design and Analysis of a Mechanism to Load Discrete Components onto a Continuous Motion Assembly Machine.</i>
1996	Jerome Kiley	<i>An Experimental Investigation of Clearance on the Frequency Response Characteristics of a Mechanical Revolute Joint.</i>
1997	Bruce Plasse	<i>Dynamic Characterization of Microcellular Urethane Jounce Bumpers under Impact Conditions</i>
1998	Gregory D. Aviza	<i>An Experimental Investigation of Torque Balancing to Reduce the Torsional Vibration of Camshafts</i>
2000	Corey Maynard	<i>An Experimental Investigation of Vibration in Timing Belts.</i>
2002	Massimo Giorelli	<i>Methodology for Correlating Experimental and Finite Element Modal Analyses on Valve Trains</i>
2002	Michael Tuxbury	<i>Analytical Modeling and Design of Torque Compensating Cams</i>
2002	James Heald	<i>Noninvasive Methods for Measuring Angular Shaft Deflection</i>
2002	Kenneth Belliveau	<i>Investigation of Incipient Jump in Cam-Follower Systems</i>
2003	Matthew Munyon	<i>Design of a Dynamic Cam-Follower Test Bed</i>
2003	Raymond Jenoski	<i>Measuring and Correcting Sweep in Strip Steel.</i>
2004	David Yamartino	<i>Design and Analysis of Cam Driven Linkages</i>
2007	Girish Mali	<i>Piezoelectric Escapement Mechanism</i>
2008	Vasin Paradorn	<i>Impact Model for a Cam-Follower System with Hard Stops</i>

- 2011 Brian Benson *Design and Analysis of a Battlebot Robot*  
 2011 Joseph Mayo *Analysis of Vibratory Wear in Cam-Follower Systems*

#### SABBATICALS:

- 1996 The Gillette Co. *Design and Analysis of High-Speed Automation Machinery*  
 1997 The Chrysler Corp. *Design and Analysis of Engine and Valve Train Systems*  
 2003-4 The Gillette Co. *Design and Analysis of High-Speed Automation Machinery*

#### Publications:

#### Books

- B1 Norton, R.L., *Design of Machinery: An Introduction to the Synthesis and Analysis of Mechanisms and Machines*, McGraw-Hill Inc., New York  
**First edition:** 743 pp., 1992. (hardbound) ISBN 0-07-909702-2  
 International Editions, (in English) McGraw-Hill Inc., Singapore and India, 1992. ISBN 0-07-112728-3  
 Korean translation: Hee Joong Dang Co. Ltd, Seoul, Korea, 1995. ISBN 89-386-5025-1  
 Chinese translation: 1994 McGraw-Hill Inc. ISBN 0-07-112728-3  
 Spanish translation: McGraw-Hill International Enterprise Limited, 1996. ISBN 970-10-0820-0  
**Second Edition:** 832 pp., 1999. (hardbound) ISBN 0-07-913272-3  
 International Editions, (in English) McGraw-Hill Inc., Singapore and India, 1999  
 New Media Version: 832 pp., 2000. (Hardbound) ISBN 0-07-242351-X  
 Spanish translation: McGraw-Hill International Enterprise Limited, 2000. ISBN 970-10-2655-1  
 Korean translation: Hee Joong Dang Co. Ltd, Seoul, Korea, 2001. , ISBN 89-888-2521-7  
 Chinese translation: McGraw-Hill International Enterprise Limited, 1999.  
 Persian Translation (unauthorized)  
**Third edition:** 880 pp., 2004. (hardbound) ISBN 0-07-247046-1  
 International Editions, (in English - softbound) McGraw-Hill Inc., Singapore and India, 2004  
 Chinese translation: McGraw-Hill International Enterprise Limited, 578 pp. 2005. ISBN 986-157-063-2  
 Spanish translation: McGraw-Hill International Enterprise Limited, 2005. ISBN 970-10-4656-0  
 Korean translation: Hee Joong Dang Co. Ltd, Seoul, Korea, 2005. , ISBN 89-888-256-75  
 Turkish translation: McGraw-Hill International Enterprise Limited, 2005.  
**Fourth edition:** 848 pp., 2008 (hardbound) ISBN 978-0-07-312158-1  
**Fifth edition:** 880 pp., 2011 (hardbound) ISBN 978-0-07-312158-1  
 Spanish translation: McGraw-Hill International Enterprise Limited, 2012.
- B2 Norton, R.L., ed., *Chap 7, Cams and Followers*, in *Modern Kinematics* , A. Erdman ed., John Wiley & Sons, New York, 1993, ISBN 0-471-55459-6.
- B3 Norton, R. L., *Machine Design: An Integrated Approach*, Prentice-Hall,  
**First edition:** 1072 pp., 1996, (hardbound) ISBN 0-13-555475-6 and ISBN 0-13-565011-9.  
 International Edition, (in English - softbound) Prentice-Hall, 1072 pp., 1996, ISBN 0-13-254012-6.  
 Revised Printing. 1072 pp., 1998, (hardbound) ISBN 0-13-897802-6.  
 Korean translation, Bando Publishing Inc., Korea. 1999 (hardbound), ISBN 89-45-3027-1  
 Spanish translation, Prentice-Hall, 1999. ISBN 970-17-0257-3

**Second Edition:** 1104 pp., 2000, (hardbound) ISBN 0-13-017706-7

International Edition, 2000 (in English - softbound) Prentice-Hall, 1104 pp.

Portugese translation: 1104 pp., 2004, (hardbound) ISBN 85-363-0273-9

**Third Edition:** 998 pp. 2005, (hardbound) ISBN 0-13-148190-8

International Edition, (in English - softbound) Prentice-Hall, 998 pp. 2006

**Fourth Edition:** 1028 pp. 2011, (hardbound) ISBN 0-13-612370-8

International Edition, (in English - softbound) Prentice-Hall, 1028 pp. 2011 ISBN 0-13-138438-4

Spanish translation, Prentice-Hall, 2012. ISBN 9786074424799

**Fifth Edition:** 1060 pp. 2014, (hardbound) ISBN 0-13-335671-7

B4 Norton, R. L., *The Cam Design and Manufacturing Handbook*, The Industrial Press, New York, NY, 2002.

**Second Edition:** 592 pp., 2009. (hardbound) ISBN 978-0-8311-3367-2

B5 Norton, R.L., *Fundamentals of Machine Design* 1ed. McGraw-Hill International Enterprise Limited, 2006, (softbound) ISBN 0-07-123-73-3X

B6 Norton, R.L., *Kinematics and Dynamics of Machinery* 1ed. McGraw-Hill International Enterprise Limited, 2008 (softbound), ISBN 978-007-127852-2

Korean translation, McGraw-Hill Inc., Korea. 552 pp., 2010 (hardbound), ISBN 89-6055-092-2

Portugese translation, McGraw-Hill Inc. 800 pp., 2009, (softbound), ISBN 0071278524

**Second Edition:** 886 pp., 2012 (in press)

## Book Reviews

“Motor Vehicle Dynamics: Modeling and Simulation,” by G. Genta. Reviewed by R. L. Norton in *Applied Mechanics Reviews*, Vol. 51, No. 2, February, 1998.

“Machinery Malfunction, Diagnosis, and Correction,” by R. C. Eisemann Sr. and R. C. Eisemann Jr. Reviewed by R. L. Norton in *Applied Mechanics Reviews*, 1999

“Exact Constraint: Machine Design Using Kinematic Principles,” by D. L. Blanding. Reviewed by R. L. Norton in *Applied Mechanics Reviews*, Volume 53, Number 3, March 2000.

“Mechanism Design: Enumeration of Kinematic Structures According to Function.” by Lung-Wen Tsai. Reviewed by R.L. Norton in *Applied Mechanics Reviews*, Volume 54, Number 5, September 2001.

## Computer Programs:

Norton, R. L., “FOURBAR - Program for the Synthesis and Analysis of the Fourbar Linkage”, ©2006

Norton, R. L., “FIVEBAR - Program for the Design and Analysis of the Geared Fivebar Linkage”, ©2006

Norton, R. L., “SIXBAR - Program for the Design and Analysis of the Sixbar Linkage”, ©2006

Norton, R. L., “SLIDER - Program for the Design and Analysis of the Offset Slider-Crank Linkage”, ©2006

Norton, R. L., “DYNACAM - Program for the Design and Analysis of Cam-Follower Systems”, ©2014

Norton, R. L., “ENGINE - Program for the Design and Analysis of IC Engines and Compressors”, ©2006

Norton, R. L., “MATRIX - Program for the Solution of Systems of Linear Equations”, ©2006

Norton, R. L., “MOHR - Program for the Calculation of Principal Stresses and Mohr Circles”, ©2004

Norton, R. L., “LINKAGES - Program for the Design and Analysis of Linkages”, ©2014

## Thesis

Norton, R.L., *Design and Evaluation of an External Actuating Device for an Implanted Prosthetic Left Ventricle*, Masters Thesis, Tufts Univ., 1970.

## Refereed Journal Articles

- J1 Birtwell, S.C., Giron, F., Ruiz, U., Norton, R.L., and Soroff, H.S.: "The Regional Hemodynamic Response to Synchronous External Pressure Assist." 14:462-465, *Transactions of the ASAIO*, 1970.
- J2 Norton, R.L., Kataoka, K., Birtwell, W.C., and Soroff, H.S.: "Effects of Change of Ambient Pressure Differential on the Effectiveness of Peripheral External Assist. 17:169-173, *Transactions*, 1971.
- J3 Zhang, C.E., Norton, R.L., Hammond, T., "Optimization of Parameters for Specified Path Generation Using an Atlas of Coupler Curves of Geared Five Bar Linkages." *Mechanism and Machine Theory*, Vol. 19, No. 6., 1984.
- J4 Norton, R.L.: "Fourbar and Geared Fivebar Analysis Programs for the Apple Computer", *Mechanism and Machine Theory* Vol. 20 #4, , 1985.
- J5 Norton, R.L., "Teaching Kinematics with Microcomputers," Proceedings of the ASEE Annual Conference, Salt Lake City, Utah, June, 1984., Also published in *the CoED Journal* Vol. VI No. 1 March, 1986. (*J. Curtis Award and Merle Miller Award for best presentation/best journal article in ASEE CoED Division*)
- J6 Norton, R.L., "Effect of Manufacturing Method on Dynamic Performance of Eccentric Cams - Part I, *Mechanism and Machine Theory*, Vol.23, No. 3, pp 191-200, 1988. (*Proctor and Gamble Best Paper Award*).
- J7 Norton, R.L., "Effect of Manufacturing Method on Dynamic Performance of Double Dwell Cams, Part II," *Mechanism and Machine Theory*, Vol.23, No.3, pp 201-208, 1988. (*Proctor and Gamble Best Paper Award*).
- J8 Norton, R.L., Jacques, D., "High Order Cams Deliver Some of Their Promise," *Machine Design*, pp 138-140, September 11, 1986.
- J9 Norton, R.L., Jacques, D., "Correlation of Cam Profile Design and Manufacturing Method with Dynamic Performance of the Follower", *Manufacturing Simulation and Processes, ASME PED* V20, pp. 221-236, 1986.
- J10 Norton, R.L., Levasseur, D., Pettit, A., Dillich, S., "Effect of Initial Surface Roughness on Dynamic Performance of Plate Cams", *Theory of Machines and Mechanisms*, Vol. 3 p. 1691-1694, Bautista et al eds., Pergamon Press, London, New York, 1987.
- J11 Norton, R.L., "Analysis of the Effect of Manufacturing Methods and Heat Treatment on the Performance of Double Dwell Cams" *Mechanism and Machine Theory*, V23, No. 6, pp. 461-474, 1988.
- J12 Norton, R.L., "Teaching Cam Design Using the Graphics Microcomputer", *J. Appl. Eng. Education*, Pergamon Press, London, Vol.4, No. 2, pp 151-160., 1988.
- J13 Norton, R.L., "Teaching Dynamics of Machinery Using the Graphics Microcomputer", *J. Appl. Eng. Education*, Pergamon Press, London, Vol. 4, No. 5, 1988.
- J14 Norton, R.L., "Teaching Dynamics of Mechanisms with the Graphics Microcomputer", Proc. ASEE Annual Conf., Grayson and Biedenbach, June, 1988, Vol.5, pp 1947-1955. Also in *the CoED Journal* Vol. IX, No. 3, Sept. 1989.
- J15 Norton, R.L., "Dynamic Apparatus for Dynamic Signal Analysis", the *CoED Journal*, ASEE, Vol II No. 1, January-March 1992, pp. 2-10.
- J16 Norton, R.L., "MACHINERY- A Computer Aided Design Package for the Synthesis and Analysis of Linkages and Cams," *the CoED Journal*, ASEE, Vol II No. 2, Apr-Jun 1992, pp. 44-57. (*1992 Merle Miller Award for best journal article*)
- J17 Norton, R.L., Bernstein, R., "An Improved Laboratory Prototype Electrolarynx (LAPEL)", *Annals of Biomedical Eng.*, Vol 21, pp. 163-174, March 1993.
- J18 Norton, R.L., "Demonstration Programs for Digital Signal Processing", *the CoED Journal* Vol. IV No. 3 p. 27, 1994.
- J19 R. L. Norton, H. K. Ault, J. Wiley, T. Parks, R. Calawa and M. Wickstrand, "Bearing Forces as a Function of Mechanical Stiffness and Vibration Isolation in a Fourbar Linkage," in *Effects of Mechanical Stiffness and Vibration on Wear*, ASTM STP 1247, Raymond G. Bayer, Ed., American Society for Testing and Materials, Philadelphia, 1995.
- J20 Ault, H., and Norton, R. L., "Spline-Based Cam Functions for Minimum Kinetic Energy Follower Motion," *Applied Mechanisms Journal*, 1997.
- J21 Dimentberg, M, L. McGovern, R.L. Norton, J. Chapdelaine, R. Harrison, "Dynamics of an Unbalanced Shaft Interacting with a Limited Power Supply," *J. Nonlinear Dynamics*, 1997.

- J22 Norton, R. L., R. L. Stene, J. Westbrook III, D. Eovaldi, "Analyzing Vibrations in an IC Engine Valve Train." *Transactions of the SAE*. 1999

### Publications in Proceedings:

- P1 Soroff, H.S., Birtwell, W.C., Norton, R.L., Cloutier, C.T., Kataoka, K., and Giron, F.: "Experimental and Clinical Studies in Assisted Circulation." *Transplantation Proceedings of the Transplantation Society*, 1971, 3:1483-1489, 1971.
- P2 Norton, R.L., Birtwell, W.C., Kataoka, K., Cloutier, C.T., and Soroff, H.S.: "Counterpulsation by Application of External Pressure in the Clinical Patient in Cardiogenic Shock." *Proc. Conf Eng in Medicine and Biology*, October 1-5, 1972 (Bal Harbour, Florida).
- P3 Norton, R.L., "Optimum Design of Dynamically Loaded Beams—A Case Study." *Proceedings of the 6th Applied Mechanisms Conference*, October 1-3, 1979 (Denver, Colorado).
- P4 Norton, R.L., "Teaching CAD on the Apple Computer." *Proceedings of ASEE Annual Conference at Rochester Institute of Technology*, June 19-22, 1983.
- P5 Norton, R.L., "Graphic Simulation of Puma Robot Motions on the Apple Computer." *Proceedings of the 1983 ASME International Computers in Engineering Conference August 8-11, 1983 (Chicago)*
- P6 Norton, R.L., Kearns, J.K., "Analysis and Redesign of Failed Laybeams in a High Speed Power Loom." *Proceedings of the ASME Failure Prevention and Reliability Conference*, September 11-14, 1983 (Dearborn, Michigan).
- P7 Norton, R.L., "Manufacturing Considerations in Cam Design." *Proceedings of the 8th Applied Mechanisms Conference*, September 19-21, 1983, St. Louis, Missouri.
- P8 Ault, H.K. and Norton, R.L., "Inexpensive Computer Graphics Using Micro Computers." *Proceedings of the ASEE Frontiers in Education Conference*, October 17-19, 1983, Worcester, Mass.
- P9 Norton, R.L. and Asmus, D., "Student Robotics Projects at WPI". *Proceedings of the ASEE Frontiers in Education Conference*, October 17-19, 1983, Worcester, Mass.
- P10 Norton, R.L.: "Interactive Design of Geared Five-bar Mechanisms on the Apple Micro Computer." *Proc Int Conf on Eng and Computer Graphics*, August 27, 1984 (Beijing, China).
- P11 Ault, H.K., and Norton, R.L., "Computer Aided Design of Sculptured Surfaces for Forged Structural Parts." *Proc Int Conf on Engineering and Computer Graphics*, 1984 (Beijing, China).
- P12 Norton, R.L., "An Experimental Investigation of the Effect of Cam Manufacturing Methods on Dynamic Performance—First Report". *Proc. of the 11th Grantee's Conference of the NSF Production Research and Technology Program*, Carnegie Mellon U., Pittsburgh, PA, May 1984.
- P13 Norton, R.L., "Effect of Cam Manufacturing Method on Dynamic Performance and Fidelity of the Follower Acceleration Waveform," *Proc. of the NSF/SME Manufacturing Systems Research Conference*, May 14-17, 1985, Madison, Wisconsin.
- P14 Norton, R.L., Jacques, D., Braun, J., "Accuracy, Dynamic Performance and Audible Sound of Plate Cams Made by Various Methods," Presented at the *ASME Design Engineering Conference*, Columbus, Ohio October 5-8 1986, *ASME paper* 86-DET-103.
- P15 Bean, R., and Norton, R. L., "Adaptive Robotic Fine Positioning System" *Proc. ASME International Computers in Engineering Conference Chicago*. July 1986.
- P16 Norton, R. L., and S. Dillich, "An Experimental Investigation of the Effects of Run-in on the Dynamic Performance of Cams made by Various Methods", *Proc. of the NSF/SME Manufacturing Systems Research Conference*, 1987
- P17 Norton, R.L., A. Pettit, D. L'vasseur, M. Savage, "On the Relative Merits of Alternate Manufacturing Methods and Heat Treatments in the Production of Plate Cams", *Proc. of the First ASME Manufacturing International '88 Conference*, Atlanta, Ga. 1988.
- P18 Ault, H.K., and Norton, R.L., "Teaching Design in the Computer Classroom" *Proc. of the 8th UPCAEDMC Conference*, August 12-15, 1990, pp 100-104.
- P19 Norton, R.L., *ed.*, "Cams and Cam Follower Systems", in *Proc. of The First Forty Years of Modern Kinematics*, University of Minnesota, July 20-23, 1991.

- P20 Parks, T., J. Wiley, H. K. Ault, R.L. Norton, "CAD and Mechanism Analysis of a Fourbar Linkage", Int'l Aries User's Group Meeting, May 2-5, 1992, Lowell, Mass., pp. 237-260.
- P21 Norton, R.L., "Demonstration Programs for Digital Signal Processing", Proc of the ASEE Annual Conference, U. Illinois, Champaign-Urbana, June 1993, vol 1, pp. 64-69.
- P22 Lalopoulos, J., H. K. Ault, and R.L. Norton, "Dynamic Force Demonstrator for Classroom Use", Proc of the ASEE Annual Conference, U. Illinois, Champaign-Urbana, June 1993, vol 1, pp. 89-91.
- P23 Ault, H., and Norton, R. L., "Spline-Based Cam Functions for Minimum Kinetic Energy Follower Motion", Proceedings of the 3rd Nat'l Conf. on Applied Mechanisms and Robotics, Cincinnati OH, Nov 8-10, 1993, vol 1, pp. 2.1 - 2.6
- P24 Bejune, D. J. David, W. Oullette, B. Zeilinski, R. L. Norton, "Design of a Walking Simulator", Proc. of the ASME 23rd Biennial Mechanisms Conference, DE-Vol 71, *Machine Elements and Machine Dynamics*, ASME, 1994, pp. 463-468. (refereed)
- P25 Dimentberg, M, J. Chapdelaine, R. Harrison, R. L. Norton, "Passage Through Critical Speed with Limited Power by Switching System Stiffness", Proc. of the ASME Winter Annual Meeting, Chicago IL, Nov. 13-18, AMD-vol. 192/DE-vol 78, *Nonlinear and Stochastic Dynamics*, ASME, 1994, p. 57-67.
- P26 Norton, R. L., R. L. Stene, J. Westbrook III, D. Eovaldi, "Analyzing Vibrations in an IC Engine Valve Train." SAE Paper 980570, SAE International Convention, Detroit, MI., 1998
- P27 Norton, R. L., D. Eovaldi, J. Westbrook III, R. L. Stene, "Effect of Valve-Cam Ramps on Valve Train Dynamics," SAE Paper 1999-01-0801, SAE International Convention, Detroit, MI., March 1-4, 1999.
- P28 Plasse, B. P., Norton, R. L., "Dynamic Characterization of Microcellular Urethane Jounce Bumpers Under Impact Conditions," SAE Paper 1999-01-0035, SAE International Convention, Detroit, MI., March 1-4, 1999.
- P29 Norton, R. L., "In Search of the 'Perfect' Straight Line and Constant Velocity Too." Proceedings of the 6th Applied Mechanisms and Robotics Conference, Cincinnati, OH, Dec 12-15., 1999.
- P30 Johnson, B, D. Retzke, D. Dewitt, R. L. Norton, J. R. Hall, "Approximation of IC Engine Valve Acceleration from Proximity Probe Displacement Data," SAE Paper 2001-01-0075, SAE International Convention, Detroit, MI., March, 2001.
- P31 Gordon, R. P., R. L. Norton, "Reduction of Impact and Vibration in an Industrial Cam-Follower System Using the Splinedyne Method: A Case Study," DETC/MECH-34231, Proc. of the 2002 ASME Design Engineering Technical Conference: Sep. 29–Oct. 2, 2002, Montreal, Canada
- P32 Norton, R. L., Gillis, C. A., C. N. Maynard, "Dynamic Modeling of the Typical Industrial Cam-Follower System Part 1: Single-Degree-of-Freedom Models," DETC/MECH-34232, Proc. of the 2002 ASME Design Engineering Technical Conference: Sep. 29–Oct. 2, 2002, Montreal, Canada
- P33 Gillis, C. A., C. N. Maynard, R. L. Norton, "Dynamic Modeling of the Typical Industrial Cam-Follower System Part 2: Multi-Degree-of-Freedom Models," DETC/MECH-34233, Proc. of the 2002 ASME Design Engineering Technical Conference: Sep. 29–Oct. 2, 2002, Montreal, Canada
- P34 Churchill W. L., E. Gilman, C. Gow, D. Yamartino, R. L. Norton, "Computer-Aided Design of a Mechanism for the Continuous, Automated Assembly of Two Parts at High Speed: A Case Study," DETC/MECH-34374, Proc. of the 2002 ASME Design Engineering Technical Conference: Sep. 29–Oct. 2, 2002, Montreal, Canada
- P35 Norton, R. L., C. O'Brien, P. Duperry, J. R. Hall, "Determining the Effective Spring Rate of Air Cylinders Used to Close Cam-Follower Joints," DETC/MECH-34280, Proc. of the 2002 ASME Design Engineering Technical Conference: Sep. 29–Oct. 2, 2002, Montreal, Canada.
- P36 Agheli, M., Nestinger, S. S., Norton, R. L., "Analytical Study of Reachable Workspace for 2-RPR Planar Parallel Mechanisms," DETC2012-70193. Proc. of the 2012 ASME Design Engineering Technical Conference: Aug. 12–14, 2012, Chicago, IL.

#### Conference Presentations:

- C1 Birtwell, W.C., Kataoka, K., Norton, R.L., Soroff, H.S., and Deterling, R.A.: "The Effects of Counterpulsation on Collateral Perfusion: the Early Time Course of Development of a Myocardial Infarct." Presented at the X Congress of the International Cardiovascular Society, August 26-28, 1971 (Moscow).
- C2 Soroff, H.S., Birtwell, W.C., Messer, J.V., Banas, J.S., Cloutier, C.T., and Norton, R.L.: "Assisted Circulation." Symposium of the Italian National Research Council, May 12-13, 1972 (Rome).



- C3 Norton, R.L., "Graphic Simulation of Puma Robot Motions on the Apple Computer." Interactive Computer Graphics Session, Cal Poly, Pomona, CA Jan. 4-7, 1983.
- C4 Norton, R.L., "Anacam—A Cam Design and Analysis Program for Microcomputers," Poster Session, ASEE Annual Conference, Salt Lake City, Utah, June 1984.
- C5 Norton, R.L., "Teaching Cam Design With the Graphics Microcomputer" Poster Session at the 1987 ASEE annual meeting Reno, Nevada, June 1987.
- C6 Norton, R.L., Akkoc., Lavelle, W., "Cepstral Analysis of the Transfer Function of Normal and Pathological Human Larynxes", Proc. of the IEEE 9th Annual Conference of Engineering in Medicine and Biology, November 13-16, 1987, Boston, Mass.
- C7 Norton, R.L., "Dynamic Apparatus for Dynamic Signal Analysis", Poster session at the ASEE annual meeting, New Orleans LA, June, 1991.
- C8 Norton, R.L., "Computer Generation of Mohr's Circles for Stress Analysis", presented at the ASEE Annual Conference, U. Illinois, Champaign-Urbana, June 1993.
- C9 Norton, R. L., H. K. Ault, J. Wiley, T. Parks, R. Calawa, and M. Wickstrand, "Bearing Forces as a Function of Mechanical Stiffness and Vibration in a Fourbar Linkage", Presented at the ASTM Symposium on Effects of Mechanical Stiffness and Vibration on Wear in Test Devices and Applications, Montreal, Canada, May 1994.

#### **Invited Presentations:**

- I1 Norton, R.L., "Engineering Applications of Computer Aided Design." Carl Gunnard Johnson Colloquium Series, Worcester Polytechnic Institute, February 15, 1983.
- I2 Norton, R.L., "Software Control in Microcomputer Laboratories at WPI", Invited Panel Discussion at the 1987 ASEE Annual Meeting, Reno, Nev., June 1987.
- I3 Norton, R. L., "Design Projects at WPI", Invited seminar at University of R. I., October, 1992.
- I4 Norton, R., L., "Mechanisms, Robotics and Manufacturing", invited panel member , The 3rd Applied Mechanisms and Robotics Conf., Nov 8-10, 1993, Cincinnati, OH.
- I5 Norton, R. L., "The Changing Engineering Profession", Keynote Lecture, WPI Tau Beta Pi Chapter Annual Meeting, Worcester, Mass., April 20, 1994.
- I6 Norton, R. L., "Effects of Profile Function, Manufacturing Method and Surface Finish on the Dynamic Performance of Plate Cams for Production Machinery", Invited Presentation to Ford Motor Co. Science Research Laboratories, Dearborn, Michigan, November 29, 1995.
- I7 Norton, R. L., "Go Forth—And Fail: The Role of Failure in Design", Keynote Lecture, WPI Tau Beta Pi Chapter Annual Meeting, Worcester, Mass., December 5, 1995.
- I8 Norton, R. L., "Engineering Then and Now : Reflections on 35 years of Designing Things That Go Bump in the Night", Invited Presentation to The Gillette Company, Boston, Mass., December 13, 1995.
- I9 Norton, R. L., "Effects of Profile Function, Manufacturing Method and Surface Finish on the Dynamic Performance of Plate Cams for Production Machinery", Invited Presentation to Chrysler Motor Co. Technical Center, Auburn Hills, Michigan, January 5, 1996.
- I10 Norton, R. L., "Dynamics and Testing of Engine and Cam-Follower Systems," Invited Presentation to DaimlerChrysler Co. Technical Center, Auburn Hills, Michigan, March 5, 1999.
- I11 Norton, R. L., "Cam Design," Invited Presentation to Duracell Co. Bethel, CT, March 20-21, 2000.
- I12 Norton, R. L., "Cam Design," Invited Presentation to The Gillette Co. Boston MA, May 19-21, 2001.
- I13 Norton, R. L., "The State of Engineering Design Education: Views from Industry and Academia" Invited panelist at ASME Winter Annual Meeting, New York, November, 2001.
- I14 Norton, R. L., "Cam Design," Invited Presentation to The Gillette Co. Boston MA, May 13-16, 2002.
- I15 Norton, R. L., "Design Education at WPI" Invited Presentation at University of Texas, San Antonio, TX, January 22, 2004.
- I16 Norton, R. L., "Speed Sensitivity in Cam Driven Machinery" Invited Presentation at University of Arizona, Tucson, AZ, January 27, 2004.

- I17 Norton, R. L., “Controlling Vibration in Cam Driven Machinery” Invited Presentation at Arizona State University, Tempe, AZ, January 30, 2004.
- I18 Norton, R. L., “Modern Cam Design” Invited Presentation at San Jose State University, San Jose CA, February 5, 2004.
- I19 Norton, R. L., “Design Education at WPI” Invited Presentation at Stanford University, Stanford CA, February 6, 2004.
- I20 Norton, R. L., “Design Education at WPI” Invited Presentation at Georgia Tech, Atlanta, GA, February 20, 2004.
- I21 Norton, R. L., “Design Education at WPI” Invited Presentation at Clemson University, Clemson, SC, February 23, 2004.
- I22 Norton, R. L., “Modern Cam Design” Invited Presentation at Virginia Tech, Blacksburg, VA, February 25, 2004.
- I23 Norton, R. L., “Modern Cam Design” Invited Presentation at University of Delaware, March 2, 2004.
- I24 Norton, R. L., “Design Education at WPI” Invited Presentation at University of Pennsylvania, Philadelphia, PA, March 3, 2004.
- I25 Norton, R. L., “Modern Cam Design” Invited Presentation at Keurig Inc, Reading, MA, Jan 4, 2011.
- I26 Norton, R. L., “Cam Design,” Invited Presentation to P&G Tambrands, Auburn, ME, Aug, 27-28, 2013.

## Consulting

The Gillette Co. Inc, Boston, Berlin, London  
 Braun Inc., Kronberg, Germany  
 Duracell Inc., Bethel, CT  
 FMC Food Technology Inc., Lakeland, FL  
 Norton America LLC, Gladstone, OR  
 ADEPT Engineering, Glens Falls, NY  
 Kenyon and Kenyon, NY  
 Greenblum and Bernstein, Washington D.C.  
 U. S. Filter Co., Sturbridge, MA  
 Harwood Engineering Inc., Walpole, MA  
 E-Z-EM Inc., Westbury, NY  
 Ebenstein & Ebenstein, P.C., Hartford, CT  
 Abrams, Roberts, Klickstein, and Levy, Boston, MA  
 Fish and Richardson, Boston, MA  
 Engineering Design and Technology, Sutton, MA  
 Creative Engineering LLC, Bronxville, NY  
 BAE Systems Inc., Merrimack, NH  
 Fox Valley Tool & Die, Kaukama, WI  
 Ilmor Engineering Inc., Plymouth, MI  
 Palmer Assoc., Toledo, OH  
 Procter and Gamble, Cincinnati, OH  
 Smiths Medical, St. Paul, MN  
 Phillips Medical, Reedsville, PA  
 Applied Analytics, Concord, MA  
 Autotech Inc, Sylvania, OH  
 Vapor Locomotive, Cheyenne, WY  
 O’Neil Power Systems, Lakeville, MA  
 Keurig Inc, Reading MA  
 Siemens-Morgan, Worcester, MA  
 Exact Engineering, Wellesley, MA  
 Busek Co. Inc, Natick, MA  
 IMPCO Technologies, Santa Ana, CA  
 Machine Engineering Inc., Jacksonville, FL  
 Carnaud Metalbox Engineering, West Yorkshire, England  
 Guaranteed Power International, Inc, Pembroke, MA  
 Chrysler Corp., Auburn Hills, MI