

CURRICULUM VITAE

Lawrence E. Carlson
Professor of Mechanical Engineering
Founding Co-Director, Integrated Teaching and Learning Laboratory and Program

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Born December 22, 1944
Milwaukee, WI

Education, Professional Training and Registration

B.S., Mechanical Engineering, University of Wisconsin, Jan. 1967
M.S., Mechanical Engineering, University of California at Berkeley, Jun. 1968
D.Eng., Mechanical Engineering, University of California at Berkeley, Sep. 1971
Engineer-in-Training (EIT), Wisconsin

Professional Experience

IDEO Fellow, IDEO Product Design and Development, Palo Alto, CA, Spring 2001
Professor, Dept. of Mechanical Engineering, University of Colorado, Boulder, 1994-present
Founding Co-Director, Integrated Teaching and Learning Program and Laboratory, College of Engineering and Applied Science, University of Colorado, Boulder, 1992-2007
Visiting Associate Professor, Dept. of Mechanical Engineering, Stanford University, 1990-91
Associate Professor, Dept. of Mechanical Engineering, University of Colorado, Boulder, 1978-1994
Engineering Consultant, Ponderosa Associates, Lafayette, CO, 1983-present
Principal Research Fellow, Biomechanical Research & Development Unit, Dept. of Health and Social Security, London, 1979-80
Assistant Professor, Dept. of Engineering Design and Economic Evaluation, University of Colorado, Boulder, 1974-78
Assistant Professor of Mechanical Design, Materials Engineering Dept., University of Illinois at Chicago Circle, 1971-74
Research Assistant, Biomechanics Laboratory, University of California at Berkeley, 1970-71

Society Membership

Founding Member, Rehabilitation Engineering Society of North America
Member, American Society of Mechanical Engineers
Member, Phi Eta Sigma
Member, Pi Tau Sigma
Member, Sigma Xi
Member, International Society of Prosthetics and Orthotics
Member, American Society for Engineering Education

Grants

National Institutes of Health, Bioengineering Traineeship, 1967-70
National Science Foundation International Travel Grants to Yugoslavia, 1972 & 1975
National Science Foundation Research Initiation Grant, 1973-74
Veterans Administration grant, "Mobility system for adult paraplegics", 1976-77
Veterans Administration grant, "Position control of above-elbow prostheses", 1977-79
National Institutes of Health, Research Career Development Award, 1976-81
IBM Grant, "Mechanical design for robotic assembly", 1984-87
Veterans Administration grant, "Implementation of extended physiological proprioception for prosthesis control", 1985-88
National Institute on Disability and Rehabilitation Research, Field-Initiated Research Grant, "Improved actuation of body-powered prostheses", 1987-90
National Center for Medical Rehabilitation Research (within NIH), Grant, "Improving prosthetic prehension", 1992-94
Colorado Commission on Higher Education Program of Excellence, "K-16 integrated engineering outreach", co-PI, 1998-2003
National Science Foundation, GK-12 Graduate Teaching Fellows Grant, "Creating an integrated engineering and technology education continuum", co-PI, 1999-2002

Honors and Awards

Bronze Award, Lincoln Arc Welding Design Competition, 1981
American Men and Women in Science
Vince Kontny Award - Outstanding Undergraduate Advisor, University of Colorado, College of Engineering and Applied Science, 1990
Outstanding Undergraduate Advisor, Council on Academic Advising, University of Colorado, 1990
National Institute on Disability and Rehabilitation Research, Mary E. Switzer Distinguished Research Fellowship, 1990-91
Teaching Award, Mechanical Engineering Department, 1995
Sullivan-Carlson Innovation in Education Award – Annual award to honor an engineering faculty member, nominated by engineering students, endowed by the student-run Engineering Excellence Fund in the names of Jacquelyn F. Sullivan and Lawrence E. Carlson at the dedication of the ITL Laboratory, 1997
IDEO Fellow, IDEO Product Design and Development, Palo Alto, CA, 2001
Charles Hutchinson Outstanding Teaching Award, College of Engineering and Applied Science, 2001
John and Mercedes Peebles Innovation in Education Award, College of Engineering and Applied Science, 2004
Excellence in Teaching Award, Boulder Faculty Assembly, University of Colorado, 2008
Bernard M. Gordon Prize for Innovation in Engineering and Technology Education, National Academy of Engineering (co-recipient with Jacquelyn Sullivan), 2008

Patents

LeBlanc, M., Nelson, C. & Carlson, L., "Rotary Thumb Prosthesis", U.S. Patent No. 4,990,162, Feb. 1991.
Carlson, L.E., Frey, D.D. & Brown, E.S., "Locking Mechanism for Voluntary Closing Prosthetic Prehensor", U.S. Patent No. 5,800,571, Sep. 1998.
Giffin, J., Rushwald, B. & Carlson, L.E., "Rotatably Adjustable Snowboard Binding," U.S Patent No. 7,410,177, Aug. 2008.

Giffin, J., Rushwald, B. & Carlson, L.E., "Step-in Telemark Ski Binding," U.S. Patent approved 2008.

Publications

Carlson, L.E. (1970). "Below elbow control of an externally-powered hand", *Bulletin of Prosthetics Research*, BPR 10-14: 43-61.

Carlson, L.E. (1971). "Multi-mode control of an above-elbow prosthesis", Biomechanics Laboratory, University of California, Berkeley, Technical Report 61: 231 pp.

Carlson, L.E. (1971). "Report on the multi-mode arm", Report, Ninth Workshop Panel on Upper-Limb Prosthetics of the Subcommittee on Design and Development, NAS-NRC, Appendix I.

Carlson, L.E. (1972), "Closed loop position control of a pneumatic prosthesis", *Proceedings*, 25th Annual Conference on Engineering in Medicine and Biology: 97.

Carlson, L.E. & Radcliffe, C.W. (1972), "Control of artificial arm kinematics", ASME Paper No. 72-MECH-89: 8 pp.

Carlson, L.E. & Radcliffe, C.W. (1973), "A multi-mode approach to coordinated prosthesis control", *Advances in External Control of Human Extremities*, M. Gavrilovic and A. Wilson, Jr., Eds, Yugoslav Committee for Electronics and Automation, Belgrade: 185-196.

Carlson, L.E. (1974) "Simulation of body-powered above-elbow prostheses", ASCE National Structural Engineering Meeting, Preprint 2242: 20 pp.

Carlson, L.E. & Yeung, Q.S. (1974), "Optimization of kinematic coupling in above-elbow prostheses", *Advances in Bioengineering*, J. Brighton and S. Goldstein, Eds., American Society of Mechanical Engineers: 111-114.

Carlson, L.E. (1974), "Gait evaluation as a practical clinical tool", *Proceedings*, Fifth Annual Biomechanics Conference on the Spine, University of Colorado, Boulder: 197-218.

Carlson, L.E. and Yeung, Q.S. (1975), "The mechanics of dual-control above-elbow prostheses", *Annals of Biomedical Engineering*, 3: 1-12.

Carlson, L.E. (1975), "Position control of powered prostheses", *Proceedings*, 38th Annual Conference on Engineering in Medicine and Biology: 8.3.

Carlson, L.E. (1975), "An above-elbow prosthesis with optimized coordination", *Advances in External Control of Human Extremities*, Dubrovnik, Yugoslavia: 479-488.

Ogle, J.P., Andriacchi, T.P., Galante, J.O., Kaushal, S.P. and Carlson, L.E. (1975), "The velocity dependence of some characteristics of gait", *Proceedings*, 28th Annual Conference on Engineering and Medicine in Biology: 159.

Carlson, L.E. and Childress, D.S. (1975), "The lift lock: a device to increase the lifting ability of dual-control prostheses", *Bulletin of Prosthetics Research*, BPR 10-23: 158-168.

Andriacchi, T.P., Galante, J.A., Kaushal, S.P. and Carlson, L.E. (1975), "Time distance measurement as a basis for normal and clinical gait studies", *1975 Advances in Bioengineering*, A. Bell and R. Nerem, Eds., American Society of Mechanical Engineers: 107-108.

Carlson, L.E. and Ball, L.D. (1975), "Experimental biomechanics of the spine", *Proceedings*, Sixth Annual Biomechanics Conference on the Spine, University of Colorado, Boulder: 195-246.

Carlson, L.E. and Ball, L.D. (1976), "Behavior of the lumbar spine in bending", *Proceedings*, Seventh Annual Biomechanics Conference on the Spine, University of Colorado, Boulder: 225-250.

Carlson, L.E. and Hock, D.D. (1977), "Kinematic analysis of coupled arm prostheses", *Journal of Biomechanical Engineering* 99-2:110-115.

- Carlson, L.E. and Primmer, K.R. (1978), "Extended proprioception for electric prostheses", Supplement to *Advances in External Control of Human Extremities*, Dubrovnik, Yugoslavia: 201-211.
- Carlson, L.E. and Prast, M.T. (1978), "A mobility system for adult paraplegics", Supplement to *Advances in External Control of Human Extremities*, Dubrovnik, Yugoslavia: 81-91.
- Carlson, L.E. (1981), "A simple device to measure range of joint motion", Biomechanics Symposium, American Society of Mechanical Engineers: 303-306.
- Carlson, L.E. and Dewar, M. (1981), "A goniometer for simplified gait analysis", *Advances in External Control of Human Extremities*, Dubrovnik, Yugoslavia: 351-360.
- Carlson, L.E. (1982), "Biomechanics and the spine", *Advances in Conservative Health Science*, Logan Chiropractic College, *JMPT*: 25 pp.
- Carlson, L.E. and Suh, C.H. (1982), "A new chiropractic instrument: Adjusting force transducer (AFT): Its purpose and development", *Proceedings*, 13th Annual Biomechanics Conference on the Spine, University of Colorado, Boulder: 73-85.
- Carlson, L.E. (1983), "Evaluation of two adjusting force transducers", *Proceedings*, 14th Annual Biomechanics Conference on the Spine, University of Colorado, Boulder.
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- Carlson, L.E. and Heim, R. (1989), "Holding assist for a voluntary-closing prosthetic prehensor", *Issues in the Modeling and Control of Biomechanical Systems*, American Society of Mechanical Engineers, DSC-Vol. 17: 79-87.
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- Carlson, L.E. (1991), "Improved actuation of body-powered prostheses", *J. Rehab. Research and Development*, Vol. 28, No. 1, pp. 12-13.

- Winter, W.G. and Carlson, L.E. (1991), "Implementation of extended physiological proprioception for prosthesis control", *J. Rehab. Research and Development*, Vol. 28, No. 1, p. 15.
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- Wallace, S.A. and Carlson, L.E. (1992), "Critical variables in the coordination of normal and artificial limbs", *Tutorials in Motor Behavior II*, G.E. Stelmach and J. Requin, Eds., Elsevier Science Publishers, B.V., pp. 321-341.
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- Carlson, L.E. (1992), "Synergetic prehension", *Proceedings*, Seventh World Congress of the International Society for Prosthetic and Orthotics, Chicago, IL. p. 61.
- Carlson, L.E., (1992), "Control of powered arm prostheses with extended physiological proprioception", *Proceedings*, Seventh World Congress of the International Society for Prosthetics and Orthotics, Chicago, IL, p. 309.
- Carlson, L.E., LeBlanc, M.A. and Nauenberg, T. (1992), "Mechanical design of crutches", *Proceedings*, Seventh World Congress of the International Society for Prosthetics and Orthotics, Chicago, IL, p. 365.
- LeBlanc, M.A., Carlson, L.E. and Nauenberg, T. (1993), "A quantitative comparison of four experimental axillary crutches", *J. Prosthetics and Orthotics*, Vol. 5, No. 1; pp. 20-28.
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- LeBlanc, M., Setoguchi, Y., Shaperman, J. and Carlson, L.E. (1992), "Mechanical work efficiencies of body-powered prehensors for young children", *J. of the Assoc. of Children's Prosthetic Orthotic Clinics*, 27(3): 70-75.
- LeBlanc, M., Setoguchi, Y., Shaperman, J. and Carlson, L.E. (1993), "Work required for operation of body-powered upper-limb prostheses for young limb deficient children", *J. of the Assoc. of Children's Prosthetic Orthotic Clinics*, 28(1): 7-8.
- Teslow, J.L., Carlson, L.E. and Miller, R.L. (1994), "Constructivism in Colorado: Applications of recent trends in cognitive science", *Proceedings*, ASEE Annual Conference, Edmonton, Alberta. Session 1602.
- LeBlanc, M. and Carlson, L.E. (1994), "Lean on me", *Biomechanics*, May/June 1994: 41-44.
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- Carlson, L.E., Veatch, B.D. and Frey, D.D. (1995), "Efficiency of prosthetic cable and housing", *J. Prosthetics and Orthotics*, Vol. 7, No. 3, pp. 96-99.
- Carlson, L.E. (1995), "Improving prosthetic prehension", *Rehabilitation R&D Progress Reports 1994*, Vol. 32, Dept. of Veterans Affairs, Baltimore, MD; p. 8.
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- Frey, D.D., Carlson, L.E. and Ramaswamy, V. (1995), "Voluntary-opening prehensors with adjustable grip force", *J. Prosthetics and Orthotics*, Vol. 7, No. 4, pp. 124-131.
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- Carlson, L.E. and Brandemuehl, M.J. (1997), "A living laboratory", *Proceedings*, ASEE Annual Conference, Milwaukee, WI, June 1997, Session 3226. **(Selected as Outstanding Paper of the Year, Division of Laboratory and Experimental Studies)**
- Avery, J.P., Piket-May, M., Sullivan, J., Carlson, L., "Initial Results Teaching and Learning the Integrated Teaching and Learning Lab", on CD-ROM, *Proceedings*, 1997 IEEE Frontiers in Education Conference, November 1997, Pittsburgh, PA, Session S3F.
- Carlson, L.E., "Improved control of body-powered prehension" (1998), **Invited Paper**, *Proceedings*, Ninth World Congress, International Society for Prosthetics and Orthotics, Amsterdam, The Netherlands, June 28 - July 3, 1998, pp. 102-104.
- Avery, J.P., Chang, J.L., Piket-May, M., Sullivan, J., Carlson, L., Davis, S. (1998), "The Integrated Teaching and Learning Lab", on CD-ROM, *Proceedings*, 1998 IEEE Frontiers in Education Conference, November 1998, Tempe, AZ, Session F4D, pp. 932-936.
- Carlson, L.E. and Sullivan, J.F. (1998), "The Integrated Teaching and Learning Program: A Pioneering Learning Environment for 21st Century Engineering Education", **Invited Paper**, *Proceedings*, Engineering Foundation Conference: Realizing the New Paradigm for Engineering Education", Baltimore, MD, June 1998, pp. 110-120.
- Carlson, L.E. and Sullivan, J.F. (1999), "Hands-on Engineering: Learning by Doing in the Integrated Teaching and Learning Program," *International Journal of Engineering Education*, Volume 15, Number 1, pp. 20-31.
- Carlson, L.E. (1999), "Education Reform a Success at the University of Colorado," *Instrumentation Newsletter*, Vol. 11, No. 1, National Instruments, Spring 1999.
- Carlson, L.E., Sullivan, J.F., Poole, S. and Piket-May, M. (1999), "Engineers as Entrepreneurs: Invention and Innovation in Design and Build Courses", CD-ROM, *Proceedings*, 1999 IEEE Frontiers in Education Conference, November 1999, San Juan, Puerto Rico, pp. 11a6, 4-7.

- Lightner, M.R., Carlson, L., Sullivan, J.F., Brandemuehl, M.J. and Reitsma, René (2000), "A Living Laboratory," *Proceedings of the IEEE*, Vol. 88, No. 1, January 2000; pp. 31-40.
- Carlson, L.E. and Sullivan, J.F. (2000), "Engineers Invent and Innovate", CD-ROM, *Proceedings*, 2000 IEEE Frontiers in Education Conference, October 2000, Kansas City, MO.
- DeGrazia, J.L., Sullivan, J.F., Carlson, L.E. and Carlson, D.W. (2000), "Engineering in the K-12 Classroom: A Partnership that Works", CD-ROM, *Proceedings*, 2000 IEEE Frontiers in Education Conference, October 2000, Kansas City, MO.
- Sullivan, J.F., Carlson, L.E. and Carlson, D.W. (2001), "Developing Aspiring Engineers into Budding Entrepreneurs: An Invention and Innovation Course", *Journal of Engineering Education*, Oct. 2001, pp. 571-576.
- DeGrazia, J.L., Sullivan, J.F., Carlson, L.E. and Carlson, D.W. (2001), "A K-12/University Partnership: Creating Tomorrow's Engineers", *Journal of Engineering Education*, Oct. 2001, pp. 557-563.
- Knight, D.W., Sullivan, J.F., Poole, S.J, Carlson, L.E. (2002), "Skills Assessment In Hands-On Learning And Implications For Gender Differences In Engineering Education," *Proceedings*, American Society for Engineering Education Annual Conference, June 2002, Session 2430.
- Carlson, L.E. and Sullivan, J.F. (2002), "Exploring Entrepreneurship Through Product Development - A Hands-On Approach", *Proceedings*, American Society for Engineering Education Annual Conference, June 2002, Session 1354.
- Carlson, L.E. and Sullivan, J.F. (2002), "Learning By Doing - Hands-On Learning Pervades The Integrated Teaching And Learning Program", 14th US National Congress of Theoretical and Applied Mechanics, June 2002.
- Sullivan, J.F., Knight, D.W. and Carlson, L.E. (2002), "Team Building in Lower Division Projects Courses", CD-ROM, *Proceedings*, 2002 ASEE/IEEE Frontiers in Education Conference, November 2002, Session 1571.
- Carlson, L.E., Reitsma, R.F., Brandemuehl, M.J., Hertzberg, J.R., Sullivan, J.F. and Gabbard, S.G., (2003), "Exploiting an Engineering *Building* as a Unique Distance Learning Tool," *International Journal of Engineering Education*. Vol. 19(3), pp. 379-388.
- Gall, K.A., Knight, D.W., Carlson, L.E. and Sullivan, J.F. (2003), "Making the Grade with Students: The Case for Accessibility," *Journal of Engineering Education*, Vol. 92, No. 4, pp. 337-344.
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- Carlson, L.E. and Sullivan, J.F. (2003), "Exploiting Design to Inspire Interest in Engineering Across the K-16 Engineering Curriculum," *Proceedings*, Designing Engineering Education, Mudd Design Workshop IV, Harvey Mudd College, July 2003.
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- Carlson, L.E. and Sullivan, J.F. (2004), "Exploiting Design to Inspire Interest in Engineering Across the K-16 Engineering Curriculum," *International Journal of Engineering Education*, Vol. 20(3), pp. 372-378.

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Carlson, L.E. and Sullivan, J.F. (2005), "Bridging the Gap between Invention and Innovation," *International Journal of Engineering Education*, Vol. 21(2), 7 pp.

Carlson, L.E. (2005), "Rapid Prototyping to Cement CAD Modeling Skills," CD-ROM, *Proceedings*, American Society for Engineering Education Annual Conference, June 2005, Session 2252, 6 pp.

Carlson, L.E. (2005), "Virtual CAD Parts to Enhance Learning of Geometric Dimensioning and Tolerancing," CD-ROM, *Proceedings*, American Society for Engineering Education Annual Conference, June 2005, Session 2126, 10 pp.

Carlson, L.E. and Sullivan, J.F. (2006), "A Multi-Disciplinary Design Environment," *Proceedings*, IDETC/CIE 2006, ASME 2006 International Design Engineering Technical Conferences, September 10-13, Philadelphia, PA, Paper DETC2006-99148, 6 pp.

Kotys-Schwartz, D., Carlson, L. and Reamon, D. (2006), "Evaluation of the Impact of Interactivity on Student Performance," *Proceedings*, American Society of Engineering Education Conference & Exposition, June 2006, Chicago, IL.

Knight, D.W., Carlson, L.E. and Sullivan, J.F. (2007), "Improving Engineering Student Retention through Hands-On, Team Based, First-Year Design Projects," *Proceedings*, First International Conference on Research in Engineering Education, June 2007, Honolulu, HI.