

## Curriculum Vitae of Richard W. Marklin, Jr., Ph.D., CPE

### Office:

Marquette University  
 Dept. of Mechanical Engineering  
 P.O. Box 1881  
 Milwaukee, WI 53201-1881  
 (414) 288-3622; fax (414) 288-7790  
 University website: [richard.marklin@marquette.edu](mailto:richard.marklin@marquette.edu)  
 Personal website: <http://www.eng.mu.edu/~marklin/>

### Home:

7204 Aetna Ct.  
 Wauwatosa, WI 53213  
 (414) 771-ERGO (3746)

### RESEARCH INTERESTS

Ergonomics, human factors engineering, work-related musculoskeletal disorders (MSDs) carpal tunnel syndrome, hand tool and product design, workplace design

### EDUCATION

- Ph.D.** August, 1991, The Ohio State University  
 Department of Industrial and Systems Engineering  
 Dissertation: Quantification of the association between wrist motion and incidence of cumulative trauma disorders (CTDs) in industry
- M.S.** March, 1988, The Ohio State University  
 Department of Industrial and Systems Engineering  
 Thesis: The effects of hammer handle angle on wrist motion, hammering performance, and subjective ratings.
- B.F.A.** With distinction, 1981, The University of Kansas  
 Industrial Design; integration of ergonomics into consumer products

### WORK EXPERIENCE

- 2005 **Professor of Mechanical and Biomedical Engineering**  
 Marquette University, Milwaukee, WI  
 Department of Mechanical Engineering  
 (Joint appointment in the Dept. of Biomedical Engineering)  
*Responsibilities: teaching undergraduate and graduate courses in the Industrial Engineering curriculum, ergonomics and biomedical engineering research, advising students, directing the Industrial Ergonomics Laboratory, community service.*
- 1997 to 2005 **Associate Professor of Mechanical, Industrial and Biomedical Engineering**  
 Marquette University, Milwaukee, WI  
 (Joint appointment in the Dept. of Biomedical Engineering)
- 1991 to 1997 **Assistant Professor of Mechanical and Industrial Engineering**  
 Marquette University, Milwaukee, WI

- 1993 to 2003    **Consultant**  
 Ametek Inc., Racine, WI  
*Responsibilities: As a consultant to Ohio State University Biodynamics Associates, I established an ergonomics program and process at a motor manufacturing plant that employs over 300 hourly workers.*
- Jan. 1989    **Graduate Research Associate**  
 to    The Ohio State University, Columbus, OH  
 Dec. 1990    Research funded by National Institute for Occupational Safety and Health (NIOSH) (grant nos. 1 R01 OH 02621-01 and 02)
- Objective: establish a quantitative link between specific wrist motions and risk of CTDs.  
*Responsibilities: assisted in writing grant proposal, industrial surveillance of wrist motion with goniometric instrumentation, laboratory experimentation, biomechanical modeling, statistical analysis, and EMG assessment.*
- 1988 to 89    **Graduate Research Associate**  
 The Ohio State University, Columbus, OH  
 Research funded by the Food Marketing Institute (FMI)  
 Objective: quantitatively assess the wrist motion components of retail grocery clerks.  
*Responsibilities: development and testing of goniometric instrumentation, experimental design, development of research protocol in use in laboratory, collection of data, and statistical analysis.*
- 1981 to 85    **Senior Associate Industrial Designer**  
 IBM, Rochester, MN  
*Responsibilities: new product development of IBM System/36 processors (5362 and 5364) and several conceptual processors and systems; worked closely with Human Factors staff in product development of VDTs and processors.*

### ***PROFESSIONAL REGISTRATION***

CPE, Certified Professional Ergonomist, #405, August 5, 1994

### ***MEMBERSHIPS***

1987 to present    Human Factors and Ergonomics Society (HFES)  
 1987 to present    International Ergonomics Association (IEA)

## **PATENTS AND TECHNICAL DISCLOSURES**

- 1984, 1986      Technical disclosures in IBM Technical Disclosure Bulletin.  
 1985, 1987      U.S. Patents on the IBM 5362 and 5364 systems.  
 March 20, 2001 U.S. Patent on Ergonomic Dental Stool US D439,066 S (Kevin Cherney)  
 (Note: The stool was designed to a large extent by Kevin Cherney, a former graduate student of R.W. Marklin and a co-holder of this patent, while he was supported by a grant from The Brewer Co. and performing graduate work at Marquette University. Although R.W. Marklin is not a holder of this patent, he was the P.I. of the grant from The Brewer Co.)

## **AWARDS AND HONORS TO R.W. MARKLIN AND STUDENTS**

**2010** – Best Presentation at the Ergonomics Committee sessions during the American Industrial Hygiene Conference & Exhibition (AIHCE), Denver, CO, May 24, 2010.

**2009** - *1<sup>st</sup> Place in Department of Mechanical and Industrial Engineering Graduate Poster Competition: Stephen Freier (R. Marklin and P. Papanek, Advisors). “Office Chair Reduces Heart Rate”*

**2007** – *2nd Place in Department of Mechanical Engineering Graduate Poster Competition: Hector Sánchez (R. Marklin Advisor). “Biomechanical Analysis of Screwdriver Handle Designs”*

**2006** – *Robert and Mary Gettel Faculty Award for Teaching Excellence (one of 3 awarded annually from the University). Cash award of \$5000.*

**2006** – *Outstanding Researcher Award in the College of Engineering (one awarded annually from the College). Cash award of \$1000.*

**2004** – *1<sup>st</sup> Place in Department of Mechanical and Industrial Engineering Graduate Poster Competition: Megan Conrad (R. Marklin Advisor). “Evaluation and Design of a Motorcycle Clutch”*

**2004** – *3rd Place in Department of Mechanical and Industrial Engineering Graduate Poster Competition: Lia Lazard (R. Marklin Advisor). “Evaluation of a Tool that Removes and Replaces a Manhole Cover”*

**2003** – *1<sup>st</sup> Place in the College of Engineering and Dept. of Mechanical and Industrial Engineering Senior Design Competition: Tony Patrick, Tom Jacobson and Enrique Bonugli (R.W. Marklin, Advisor). “Design of a Manhole Cover Remover”*

**2003** - *Chattanooga Group, Inc. Award for best clinical article in Physical Therapy. “Effect of Computer Keyboard Slope on Wrist Position and Forearm,” by Simoneau, G.G., Marklin R.W. and Berman, J. Physical Therapy, 83(9), 816-830, 2003.*

**1997** - *3M Office Ergonomics Prize for Best Paper at Human Factors & Ergonomic Society’s Annual Meeting. “The Effect of Split and Vertically-Inclined Computer Keyboards on Wrist and Forearm Posture,” by Marklin, R.W., Simoneau, G.G. and Monroe, J.F. In Proceedings of the Human Factors and Ergonomics Society 41st Annual Meeting, Albuquerque NM, 642-646, Sept. 22-26, 1997.*

**1994-2001 (7 consecutive years)** - *Outstanding Teacher of the Year Award, Industrial Engineering Program, Department of Mechanical and Industrial Engineering, Marquette University.*

**REFEREED JOURNAL ARTICLES IN PRINT (since 1995)**

Moriguchi, C., Carnaz, L., Miranda Jr., L.C., Marklin, R.W., Gil Coury, H. (August, 2012). Are posture data from simulated tasks representative of field conditions? Case study for electric utility overhead workers. *Ergonomics*, DOI:10.1080/00140139.2012.708439.

Moriguchi, C.S., Carnaz, L., Carlos de Miranda Jr., C., Marklin, R.W., Gil Coury, H.J.C. (2012). Biomechanical analysis of loading/unloading a ladder on a truck. *WORK: A Journal of Prevention, Assessment & Rehabilitation*, Vol. 41, pp. 2492-2495.

Stone, R. Marklin, P. Seeley, and G. Mezei, A collaborative effort to apply ergonomics to electric utility workers at generating stations (2011). *WORK: A Journal of Prevention, Assessment & Rehabilitation*. Volume 39, No. 2, Nov. 2011. pp. 103 – 111.

Saginus, K., Marklin, R., Seeley, P., and Freier, S. (2011). Optimal location of mobile computer in a vehicle cab based on physical ergonomics. *Human Factors*, Vol. 53, No. 5, 474-488.

Markin, R.W., Saginus, K., Seeley, P., and Freier, S. (2010). Comparison of anthropometry of US electric field workers with North American databases. *Human Factors*, Volume 52, No. 6, Dec. 2010, 643-662.

Harivanam, S., Marklin, R.W., Papanek, P.E., and Cariapa, V. (2010). A Shovel with a perforated blade reduces normalized energy expenditure required for digging and shoveling wet clay. *Human Factors*, Vol. 52, No. 4, pp. 492–502

Weiszczyk, S., Marklin, R.W., Sanchez, H.J. (2009). Height of industrial hand wheel valves affect torque exertion. *Human Factors*, 51(4), 487-496.

Seeley, P., Marklin, R., Usher, D. and Yager, J. (2008). Case Study Report: Business Case for implementing battery-powered tools for direct-bury line workers at an electric power utility. *Journal of Occupational and Environmental Hygiene*, 5:D86-D91.

Buften, M., Marklin, R.W., Nagurka, M.L., and Simoneau, G.G. (2006). Finger typing forces applied to conventional and notebook computer keyboards. *Ergonomics*, Vol. 49, No. 10, 996-1012.

Stone, A., Usher, D., Marklin, R., Seeley, T. and Yager, J. (2006). Case study for underground workers at an electric utility: How a research institution, university and industry collaboration improved occupational health through ergonomics. *Journal of Occupational & Environmental Hygiene*, 3: 397-407.

Nagurka, M.L. and Marklin, R.W. (2005). Measurement of impedance characteristics of computer keyboard keys. *J. of Dynamic, Systems, and Motion Controls*, Vol. 127, 283-288. .

Marklin, R.W. and Cherney, K. (2005). Working postures of dentists and dental hygienists. *Journal of the California Dental Association*, 33(2), 133-136.

Marklin, R.W. and Simoneau, G.G. (2004). Design features of alternative computer keyboards: A review of experimental data. *Journal of Orthopaedic and Sports Physical Therapy*, 34(10), 638-649.

Marklin, R.W., Lazuardi, L., and Wilzbacher, J. (2004). Measurement of handle forces for crimping connectors and cutting cable in the electric power industry. *International Journal of Industrial*

*Ergonomics*, 34, 497-506.

Simoneau, G.G., Marklin, R.W., and Berman, J.E. (2003). Effect of computer keyboard slope on wrist position and forearm electromyography of typists without musculoskeletal disorders. *Physical Therapy*, 83(9), 816-830.

Seeley, P. and Marklin, R.W. (2003). Cost justification of battery-operated tools for overhead line workers in the electric power industry. *Applied Ergonomics*, 34(5), 429-439.

Simoneau, G.G. and Marklin, R.W. (2001). Effect of computer keyboard slope and height on wrist extension angle. *Human Factors*, 43(2), 287-298.

Marklin, R.W. and Simoneau, G.G. (2001). Effect of setup configurations of split computer keyboards on wrist angle. *Physical Therapy*, 81(4), 1038-1048.

Marklin, R.W., Simoneau, G.G. (2000). Biomechanical analysis of wrist ulnar deviation from typing on conventional and split keyboards. *Encyclopedia of Ergonomics and Human Factors*, 883-887..

Marklin, R.W., Simoneau, G.G., and Monroe, J.F. (1999). Wrist and forearm posture from typing on split and vertically-inclined computer keyboards. *Human Factors*, Vol 41, No. 4, 559-569.

Simoneau, G.G., Marklin, R.W., and Monroe, J.F. (1999). Wrist and forearm posture of users of conventional computer keyboards. *Human Factors*, Vol. 41, No. 3, 413-424.

Marklin, R.W. and Wilzbacher, J.R. (1999). Four assessment tools of ergonomics interventions: Case study at an electric utility's warehouse system. *American Industrial Hygiene Association Journal*, Vol 60, 777-784.

Marklin, R.W. and Monroe, J.F. (1998). Quantitative biomechanical analysis of wrist motion in bone-trimming jobs in the meat packing industry. *Ergonomics*, 41(2), 227-237.

Marras, W.S., Marklin, R.W., Greenspan, G.J., and Lehman, K.R. (1995). Quantification of wrist motions during scanning. *Human Factors*, 37(2), 412-423.

### **BOOK CHAPTERS IN PRINT (since 1995)**

Marklin, R.W. (2006). General Knowledge Regarding Engineering Controls. Chapter 14 in *Occupational Ergonomics Handbook (2<sup>nd</sup> Edition): Interventions, Controls, and Applications in Occupational Ergonomics*. W.S. Marras and W. Karwowski (editors). CRC Press Publishers.

Marklin, R.W. (1999). Biomechanical Aspects of CTDs. Chapter 44 in *Occupational Ergonomics Handbook*, W. Karwowski and W.S. Marras (editors), 795-830, CRC Press Publishers.

### **HANDBOOKS IN PRINT**

Seeley, P. and Marklin, R.W. (2012). *EPRI Ergonomics Handbook for the Electric Power Industry: Fleet Vehicle Design*. EPRI, Palo Alto CA. 660 pages.

Seeley, P. and Marklin, R.W. (2011). *EPRI Ergonomics Handbook for the Electric Power Industry: Process and Maintenance of Fleet Utility Vehicles*. EPRI, Palo Alto CA.

Marklin, R.W., Seeley, P., and Mezei, G. *EPRI Ergonomics Handbook for the Electric Power Industry: Ergonomic Design of Substations and Ergonomic Interventions for Overhead, Underground, and Substations Tasks*. EPRI, Palo Alto CA, 2010.

Marklin, R.W., Yager, J. and Mezei, G. *EPRI Ergonomics Handbook for the Electric Power Industry: Ergonomic Interventions for Plant Operators and Mechanics in Fossil-Fueled Power Plants*, EPRI, Palo Alto CA: 2009. 1014042.

Marklin, R.W., Yager, J. and Mezei, G. *EPRI Ergonomics Handbook for the Electric Power Industry: Ergonomic Interventions for Electrical Workers in Fossil-Fueled Power Plants*, EPRI, Palo Alto CA: 2008. 1014042.

Marklin, R.W. and Yager, J. *EPRI Ergonomics Handbook for the Electric Power Industry: Ergonomic Interventions for Direct-Buried Cable Applications*, EPRI, Palo Alto CA: 2005. 1005574.

Marklin, R.W. and Yager, J. *EPRI Ergonomics Handbook for the Electric Power Industry: Ergonomic Interventions for Manhole, Vault and Conduit Applications*, EPRI, Palo Alto CA: 2004. 1005430.

Marklin, R.W. and Yager, J. *EPRI Ergonomics Handbook for the Electric Power Industry: Overhead Distribution Line Workers Interventions*, EPRI, Palo Alto CA: 2001. 1005199.

#### **REFEREED CONFERENCE PROCEEDINGS IN PRINT (since 1995)**

Bain, B. and Marklin, R (2012). An Inside Step in an Aerial Bucket Reduces Postural Instability During Ingress and Egress. *Proceedings of the Human Factors and Ergonomics Society 56th Annual Meeting*, Oct. 23-26, 2012, Boston, MA.

Moriguchi, C.S., Carnaz, L., Miranda Jr., L. C., Marklin, R.W., and Gil Coury, H.J.C. (2012). Biomechanical analysis of loading/unloading ladder on a truck. In *Proceedings of the IEA Congress*, Feb 12-16, Recife, Brazil.

Saginus, K., Marklin, R.W., Seeley, P., and Freier, S. (2011). Effects of mobile computer locations in a vehicle cab on biomechanical loading. In *Proceedings of the Human Factors and Ergonomics Society 55th Annual Meeting*, Sept. 20-23, 2011, Las Vegas, NV.

Saginus, K., Marklin, R., Seeley, P., and Freier, S. (2010). Comparison of anthropometry of US electric utility field workers to North American general population databases. In *Proceedings of the Human Factors and Ergonomics Society 54th Annual Meeting*, Sept. 28 to Oct 1, 2010, San Francisco, CA..

Freier, S., Seeley, P., Marklin, R., and Saginus, K. (2010). Application of electric utility workers' anthropometry to clearance between vehicle pedals and adjacent structures. In *Proceedings of the Human Factors and Ergonomics Society 54th Annual Meeting*, Sept. 28 to Oct 1, 2010, San Francisco, CA..

Freier, S., Marklin, R.W. and Papanek, P. (2009). Effect of inverted V-shaped backrest of an office chair on ventilatory and cardiovascular efficiency. In *Proceedings of the Human Factors and Ergonomics Society 53rd Annual Meeting*, Oct. 20-23, 2009, San Antonio, TX.

- Saginus, K., Marklin, R.W. and Voglewede, P. (2009). Dynamic modeling of hand force to close a disconnect switch at switching stations and substations. In *Proceedings of the Human Factors and Ergonomics Society 53rd Annual Meeting*, Oct. 20-23, 2009, San Antonio, TX.
- Sanchez, H. and Marklin, R. (2008). Effect of a manual screwdriver with a pistol-grip handle on maximum torque and muscle activity. In *Proceedings of the Human Factors and Ergonomics Society 52nd Annual Meeting*, Sept. 23, 2008, New York, NY.
- Wieszczyk, S. and Marklin, R. (2008). Industrial hand wheel valves: Effects of height and torque direction on maximum torque and muscle activity. In *Proceedings of the Human Factors and Ergonomics Society 52nd Annual Meeting*, Sept. 23, 2008, New York, NY.
- Seeley, P. and Marklin, R.W. (2004). Business case models: Their short- and long-term benefits. National Advisory Committee for Ergonomics (NACE). Sponsored by Occupational Safety and Health Administration (OSHA), Washington DC, Jan. 27, 2004.
- Simoneau, G.G., Marklin, R.W., Berman, J.E., Monroe, J.F., Garrison, M.K., Bielefeld, T.M. (2001). Wrist position and forearm musculature activation of subjects with carpal tunnel syndrome typing on computer keyboards of various slope angles. In *Proceedings of the Computer-aided Ergonomics and Safety (CAES) Conference*, July 29 to August 1, Maui, Hawaii.
- Simoneau, G.G., Marklin, R.W., Berman, J.E., Garrison, M.K., Bielefeld, T.M. (2001). Computer keyboard slope: wrist extension angle and forearm musculature activation. In *Proceedings of Int. Society of Biomechanics (ISB) Congress*, July 8-13, Zurich, Switzerland.
- Simoneau, G.G., Marklin, R.W., Berman, J.E., Monroe, J.F., and Welsh, S.E. (2000). Computer keyboard slope and wrist extension angle on individuals with and without carpal tunnel syndrome. In *Proceedings of the Canadian Society of Biomechanics Meeting*, August 23-26, Montreal, Canada, p. 63.
- Marklin, R.W. and Nagurka, M.L. (2000). Measurement of stiffness and damping characteristics of computer keyboard keys. In *Proceedings of the Human Factors and Ergonomics Society 44th Annual Meeting*, July 30-Aug. 4, San Diego CA, 678-681.
- Simoneau, G.G. and Marklin, R. W. (2000). Effect of computer keyboard slope and height on wrist extension angle. In *Proceedings of the 3<sup>rd</sup> Australian and New Zealand Society of Biomechanics Conference*, Queensland, Australia, Jan. 31 to Feb. 1.
- Simoneau, G.G. and Marklin, R.W. (1999). Relationship between computer keyboard slope and wrist extension angle. In *Proceedings of the Human Factors and Ergonomics Society 43th Annual Meeting*, Sept. 27 to Oct. 1, Chicago IL.
- Nagurka, M.L. and Marklin, R.W. (1999). Measurement of impedance characteristics of computer keyboard keys. 7<sup>th</sup> Mediterranean Conference on Control and Automation – MED99. Sponsored by IEEE, Haifa, Israel, June 28-30.
- Nagurka, M.L., Marklin, R.W., and Liu, C. (1999). Design of a test rig for measurement of stiffness and damping characteristics of computer keyboard keys. American Control Conference, Sponsored by ASME, IEEE, AIAA, AICHE, AISE, ASCE, ISA, and SCS, San Diego, CA, July 2-4.

Simoneau, G.G., Marklin, R.W., and Harrison, L. (1998). Effect of computer keyboard slope on users' wrist extension angle. In *Proceedings of the Scientific and Exposition of the American Physical Therapy Association*, June 4-7, Washington, DC.

Marklin, RW, Simoneau, GG, and Hoffman, D (1998). Effects of computer keyboard setup parameters and users' anthropometric characteristics on wrist deviation and typing efficiency. In *Proceedings of the Human Factors and Ergonomics Society 42th Annual Meeting*, Oct. 5-9, Chicago, IL, 876-880.

Marklin, R.W. and Wilzbacher, J. (1998). Four quantitative methods of evaluating warehouse jobs in an electric public utility. In *Advances in Occupational Ergonomics and Safety*. Presented at the International Occupational Ergonomics and Safety Conference, June 11-14, Ann Arbor, MI.

Marklin, R.W., Simoneau, G.G., and Monroe, J.F. (1997). The effect of split and vertically-inclined computer keyboards on wrist and forearm motion. In *Proceedings of the Human Factors and Ergonomics Society 41th Annual Meeting*, Sept. 22-26, Albuquerque, NM, 642-646.

Simoneau, G.G. and Marklin, R.W. (1997). Effect of computer keyboard design on wrist and forearm position while typing. In *Proceedings of the International Society of Biomechanics (ISB)*, Aug. 25-29, Tokyo, Japan.

Marklin, R.W. and Simoneau, G.G. (1996). Upper extremity posture of typists using alternative keyboards. In *Proceedings of the Silicon Valley Ergonomics Conference and Exposition*, sponsored by the Silicon Valley Ergonomics Institute (SVEI), May 12-15, Palo Alto, CA, 126-132.

Monroe, J.F. and Marklin, R.W. (1995). Quantitative biomechanical analysis of wrist motion in bone-trimming jobs in the red-meat packing industry. In *Proceedings of the Human Factors and Ergonomics Society 39th Annual Meeting*, Oct. 9-13, San Diego, CA, 595-599.

#### ***REFEREED CONFERENCE PROCEEDINGS (ABSTRACTS) IN PRINT (since 1995)***

Marklin, R.W. (2010). Recommendations of Alternative Computer Keyboards for Industrial Hygienists. Presented at the American Industrial Hygiene Conference & Exposition, Denver, CO, May 24-27, 2010.

Marklin, R.W. (2010). Electric utility workers are taller and heavier than typical anthropometry databases indicate. Presented at the American Industrial Hygiene Conference & Exposition, Denver, CO, May 24-27, 2010.

Marklin, R.W. Freier, S., and Papanek, P. (2009). A general-purpose office chair reduces heart rate during typical office tasks. Presented at the American Industrial Hygiene Conference & Exposition, Toronto, CANADA, June 1, 2009.

Marklin, R.W. and Weiszczyk, S. (2009). Low rolling resistance wheels reduce force to push carts. Presented at the American Industrial Hygiene Conference & Exposition, Toronto, CANADA, June 1, 2009.

Marklin, R.W. (2008). A methodology to assess musculoskeletal injury risk of workers in the electric utility industry. Presentation in the Roundtable: Exposure Assessment – Tools for Ergonomic Analysis of Highly Variable Jobs. Presented at the American Industrial Hygiene Conference & Exposition,

Minneapolis, MN, June 1-5, 2008.

Wieszczyck, S., Sánchez, H. and Marklin, R. (2008). Effect of valve height on musculoskeletal loading of electric utility power plant electricians. Presented at the American Industrial Hygiene Conference & Exposition, Minneapolis, MN, June 1-5, 2008.

Marklin, R., Sánchez, H., and Purvis, C. (2007). Current topics in input devices and implications for future HFES standards work: Alternative pointing devices. Presented at the *51<sup>st</sup> meeting of the Human Factors and Ergonomics Society*, Baltimore, MD, Oct 1, 2008.

Marklin, R.W. (2006). Analysis of a shovel for digging wet clay. Forum (Field and Laboratory Analysis of Physically Demanding Variable Tasks in Construction and Utilities) presented at the American Industrial Hygiene Conference and Exposition, Orlando, FL, May 17, 2006.

Seeley, P. and Marklin, R.W. (2005). Cost/benefit analyses' role in ergonomic implementation. Presented at the Applied Ergonomics Conference, New Orleans, LA, March 21-24, 2005.

Marklin, R.W. (2004). Ergonomics for overhead and underground workers in the electric power industry. Forum presented at the American Industrial Hygiene Conference and Exposition, Atlanta GA, May 10-13, 2004.

Marklin, R.W. (2003). Ergonomically designed products: which one work and which ones don't? Computer Keyboards. Forum presented at the American Industrial Hygiene Conference and Exposition, Dallas TX, May 14, 2003.

Marklin, R.W. (2002). Ergonomics for overhead distribution line workers in the electric power industry. Forum coordinated by EPRI and presented at the American Industrial Hygiene Conference and Exposition, San Diego CA, June 2-6, 2002.

Marklin, R.W. and Wilzbacher, J. (2002). Evaluation of a battery-operated press for making wire connections in the electric power industry. Presented at the American Industrial Hygiene Conference and Exposition, San Diego CA, June 2-6, 2002.

Seeley, P. and Marklin, R.W. (2002). Implementing ergonomics interventions for physically demanding jobs in the electric power industry. Presented at the American Industrial Hygiene Conference and Exposition, San Diego CA, June 2-6, 2002.

Marklin, R.W. and Nagurka, M.L. (2001). Computer Keyboard Keys: Stiffness and Damping Characteristics Presented at the American Industrial Hygiene Conference and Exposition, New Orleans LA, June 4-6.

Simoneau, G.G., Berman, J.E., Garrison, M.K., Welsch, S.E., and Marklin, R.W. (2001). Computer keyboard slope: wrist extension angle and forearm musculature activation. Arthritis Research Conference, March 23-25, San Diego CA.

Marklin, R.W. and Simoneau, G.G. (2000). Electromyographic activity of forearm flexor and extensor muscles from typing on negatively sloped computer keyboards. Presented at the American Industrial Hygiene Conference and Exposition, Orlando FL, May 20-25.

Simoneau, G.G. and Marklin, R.W. (1999). Wrist extension angle and computer keyboard slope. Arthritis

Research Conference, August 6-8, Washington DC.

Marklin, R.W. (1999). How do negatively-sloped keyboards affect wrist posture and typing performance? Presented at the American Industrial Hygiene Conference and Exposition, Toronto CANADA.

Wilzbacher, J. and Marklin, R.W. (1998). Ergonomics intervention in warehousing: Electric utility case study. Presented at the American Industrial Hygiene Conference and Exposition, Atlanta GA.

Marklin, R.W. (1997). The effect of split and vertically-inclined alternative keyboard design on wrist and forearm posture. Presented at the Marconi 1997 Research Conference, sponsored by the Office on Ergonomics Research Committee (OERC), Marshall CA.

Marklin, R.W., Simoneau, G.G., and Monroe, J.F. (1997). Wrist and forearm posture of typists using alternative keyboards. Presented at the American Industrial Hygiene Conference and Exposition, Dallas TX.

Marklin, R.W. and Cordova, R. (1995). Ergonomic handtools: Effect of handle shape and exertion level on musculoskeletal performance. Presented at the American Industrial Hygiene Conference and Exposition, Kansas City MO.

#### ***MAGAZINE ARTICLES***

Simoneau, G.G. and Marklin, R.W. (July, 2003). Keyboard question: Can alternative keyboards address the risk factors of typing? ADVANCE for the Directors of Rehabilitation, 67-69.

**PAST RESEARCH SUPPORT (since 1995)**

(Note: R.W. Marklin was the principal investigator on all the following projects except where noted.)

a) **Electric Power Research Institute (EPRI)**

Title of Project: *A Systematic Method for Specification, Purchase and Upfitting of Fleet Vehicles in the Electric Power Industry*

b) Sept. 1, 2008 to June 1, 2012

c) \$1,000,000 USD

d) The purpose of this study was to develop an efficient method for electric utilities to specify and then purchase fleet vehicles, which range from pickup trucks to aerial bucket trucks, so workers can use the trucks productively and with minimal risk of injury. This method minimized total cost of original vehicles and subsequent upfitting (retrofitting).

a) **Electric Power Research Institute (EPRI)**

Title of Project: *Evaluation and Design of Substations for Electric Utilities*

b) Jan. 1, 2008 to March 31, 2009

c) \$54,000 USD

d) The purpose of this study is to evaluate substations to determine how physical injuries and accidents can be prevented.

a) **Electric Power Research Institute (EPRI)**

Title of Project: *Ergonomics Process for Workers in Fossil Electric Power Plants*

b) June 15, 2005 to Dec. 31, 2008

c) \$468,254 USD

d) The purpose of this study was to build upon the success of the 2 previous EPRI studies for overhead and underground workers, which resulted in 3 published handbooks, and tailor an ergonomics process for electric power workers who work in fossil power plants (coal, oil or gas-powered). Two ergonomics teams will be setup at We Energies for electricians and power plant operators. The culmination of this project will be 2 ergonomics handbooks for electricians and power electricians and plant operators that will show how typical tasks can be changed to minimize the incidence and severity of work-related musculoskeletal injuries and illnesses. As with the past 2 projects, We Energies generously agreed to be the host utility for this project.

a) **Herman Miller, Inc. (Office Furniture Manufacturer)**

Title of Project: *Metabolic Study of Office Workers using an Office Chair*

b) Jan. 1, 2008 to Dec. 31, 2008

c) \$76,886 USD

d) The purpose of this study was to evaluate the cardiac and ventilatory load, as measured by heart rate (cardiac) and tidal volume and respiratory rate (ventilatory), of office workers who use a new office chair.

*Note: Dr. Paula Papanek was the P.I. on this project.*

a) **Electric Power Research Institute (EPRI)**

Title of Project: *Survey of Best Practices – Grounding a De-energized Overhead Line with a Ground Clamp Stick*

b) Jan. 1, 2008 to June 1, 2008

c) \$12,963 USD

d) The purpose of this study was to determine the best work practice to do this task to reduce risk

of injury.

a) **Electric Power Research Institute (EPRI)**

Title of Project: *Development of an Ergonomics Process for Underground Line Workers in the Electric Power Industry*

b) April 1, 2002 to March 31, 2005

c) \$351,554 USD

d) The purpose of this study was to build upon the success of the EPRI study for overhead distribution line workers and tailor an ergonomics process for electric power workers who work underground. There are two types of underground electrical work – manhole and vault and direct-buried cable. Two ergonomics teams were setup at We Energies (formerly Wisconsin Electric-Wisconsin Gas). The culmination of this project was 2 ergonomics handbooks for underground workers that showed how typical underground tasks can be changed to minimize the incidence and severity of work-related musculoskeletal injuries and illnesses. One handbook was devoted to manhole, vault and conduit applications, and the other handbook focused on direct buried cable applications. We Energies generously agreed to be the host utility for this project, and they provided hourly and management personnel and financial resources for the 2 ergonomics teams.

a) **Harley-Davidson**

Title of project: *Evaluation and Design of a Motorcycle Clutch*

b) July 1, 2003 to August 31, 2004

c) \$83,000 USD

d) The purpose of the project was to assess muscle fatigue from motorcycle drivers operating a clutch on a motorcycle during riding in traffic and to recommend design changes to reduce muscle fatigue.

a) **The Arthritis Foundation**

Title of Project: *Alternative Computer Keyboards for People with Carpal Tunnel Syndrome*

b) Jan 1, 1999 to Dec. 31, 2002

c) \$235,000 USD

d) The purpose of this study was to build upon the successes of NIOSH project on alternative keyboards, which ended Oct 31, 1996, and continue the work on developing an optimal alternative computer keyboard for persons who are diagnosed with carpal tunnel syndrome. .

e) *Note: Guy G. Simoneau, Ph.D., PT was the P.I.*

a) **Office Ergonomics Research Committee**

(A consortium of major computer and office furniture manufacturers, including IBM, Microsoft, Compaq, Steelcase, Herman Miller and others)

Title of Project: *Field Study of Negatively Sloped Keyboards in Offices*

b) January 15, 2000 to Dec. 31, 2002

c) \$13,500 USD

d) This study was a followup to a previous OERC study to determine wrist posture of office workers while they type on negatively sloped keyboards in the workplace. The investigators will measure wrist position from workers who have, on their own, selected to type on positively sloped, neutral, and negatively sloped keyboards. Regression equations relating slope of keyboard and wrist position will be developed.

e) *Co-investigator: Guy G. Simoneau, Ph.D., PT*

a) **Electric Power Research Institute (EPRI)**

Title of Project:

- Development of an Ergonomics Process for Overhead Distribution Line Workers in the Electric Power Industry*
- b) July 1, 1999 to Dec. 31, 2001
  - c) \$170,000 USD
  - d) The purpose of this study was to build upon the past success of the warehouse study for Wisconsin Electric Power Co. and tailor an ergonomics process for overhead distribution line workers, who are utility workers who build and maintain power lines. One of the outcomes of this project was an ergonomics handbook for line workers that showed how typical line workers' tasks can be changed to minimize the incidence and severity of musculoskeletal injuries and illnesses. The title of the handbook was *Ergonomics Handbook for the Electric Power Industry: Overhead Distribution Line Workers Interventions*. Wisconsin Electric-Wisconsin Gas (WE-WG) generously served as the host utility for this project and provided hourly and management staff for the ergonomics team.
- a) **Office Ergonomics Research Committee**  
(A consortium of major computer and office furniture manufacturers)  
Title of Project: *Stiffness and Damping Characteristics of Computer Keys*
  - b) January 15, 1998 to June 1, 2000
  - c) \$29,250 USD
  - d) The purpose of this project was to characterize the amount of force it takes to activate keys on a computer keyboard as a function of how quickly the key is pressed (velocity). In addition, the static force-displacement characteristics of the key will be investigated.
  - e) *Co-investigator: Mark L. Nagurka, Ph.D., PE*
- a) **Office Ergonomics Research Committee (OERC)**  
(A consortium of major computer and office furniture manufacturers)  
Title of Project:  
*The Effects of Sloped Computer Keyboards on Upper Extremity Kinematics and Muscle Fatigue*
  - b) January 15, 1998 to June 1, 2000
  - c) \$25,000 USD
  - d) The purpose of this project was to determine how a sloped conventional keyboard, in particular a keyboard sloping downward, affects the position and dynamics of the wrist and forearm. In addition, the EMG activity of the forearm muscles will be recorded to estimate the muscle activity and fatigue during typing sessions.
  - e) *Co-investigator: Guy G. Simoneau, Ph.D., PT*
- a) **Wisconsin Electric Power Co.**  
Title of project:  
*Development of an Ergonomics Process for Supply Chain of Wisconsin Electric Power Co.*
  - b) September 1, 1996 to August 31, 1998
  - c) \$79,664 USD
  - d) The purpose of this research grant was to develop and evaluate an ergonomics program and process for the Pewaukee Stores warehouse, which is the main distribution warehouse for all of Wisconsin Electric Corp. Among several candidates, Marquette University was selected to develop and evaluate, over a two year period, an ergonomics program for the Pewaukee Stores warehouse. A unique feature of the Marquette University approach is to use the infrastructure of the existing computerized inventory system at Pewaukee Stores to allocate the type, height, and weight of parts that hourly workers would handle in one shift in order to minimize musculoskeletal loads.

a) **Fiskars Inc. (Wallace Division)**, Sauk City, WI

Title of Project: *Evaluation and Design of Loppers and Hedge Shears*

b) September 1, 1997 to Aug 31, 1998

c) \$40,000 USD

d) The purpose of this project was to evaluate biomechanically existing and new designs of loppers and hedge shears that Fiskars manufactures in their Sauk City, WI plant. Testing involved recordings of electromyographic (EMG) activity from the major trunk and upper extremity muscles while subjects are cutting branches with loppers and hedge shears. In addition, strain gage technology recorded forces on cutting edge and handles in order to compute the transfer function between input (muscle force) and output (cutting force).

a) **National Institute for Occupational Safety and Health (NIOSH)**

Title of project:

*An Ergonomic Study of Alternative Keyboard Designs* (grant #1 R03 OH03184-01)

b) September 30, 1994 to October 31, 1996

c) \$72,713 USD

d) The purpose of this research grant was to determine whether commercially-available alternative keyboard designs, such as split keyboards, have a beneficial effect on the motion patterns of the upper extremities. The finger, wrist, and forearm motion were measured from experienced secretaries typing on three alternative keyboards along with a conventional, flat keyboard. This study found that alternative keyboards actually placed the wrists and forearms in a more natural posture.

a) **National Aeronautics and Space Administration (NASA) Small Business**

**Innovation Research Award (SBIR): Phase I: Pinch and Power Grip Gyrometer**

(Participating Small Business: Orbital Technology Corp., Madison, WI)

b) January 1, 1996 to June 30, 1996

c) \$20,997 for Marquette U.; \$70,000 total budget

d) Dr. Marklin and his staff at the Industrial Ergonomics Laboratory at Marquette University teamed up with Orbital Technology Corp. (ORBITEC) to research, develop, and design a device that will evaluate quantitatively the range of motion of coupled movements of the wrist and forearm and the maximum grip and pinch strength of astronauts. In Phase I, Orbitec and Marquette U. defined system requirements, designed and built a mechanical prototype, and tested and evaluated the prototype. Orbitec and Dr. Marklin submitted a proposal to NASA in June 1996 for Phase II funding, which has a duration of two years and an overall budget of \$600,000, to market and commercialize this device to occupational and physical therapists.

a) **The Brewer Company, Menomenee Falls, WI**

**Title of Project:** *Ergonomics for the Dental Office*

b) September 15, 1994 to July 15, 1995

c) \$24,785 USD

d) The purpose of this project was to provide ergonomics and engineering expertise to The Brewer Co. in their design and development of products for the dental office. Currently, The Brewer Co. manufacturers stools and patients' chairs for the dental office. However, The Brewer Co. wanted to enhance their product line with ergonomic features. In this project, Marquette University designed and developed a new ergonomic stool for the dentist and hygienist.