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Study Abroad
MS in Biomedical & Environmental Engineering

Core Faculty Profile

Richard Weir

Richard Weir

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Research Interests

My research interests are in the fields of Biomedical, Rehabilitation, and Mechatronic Engineering, specifically, artificial arm/hand systems, manipulators, robotics and their control. My primary research emphasis is in man-machine interfaces and the design of upper-limb prosthetic components and their associated control. The current focus of this work is the development of externally-powered partial hand prostheses for clinical use and the development of clinically viable multiple degree-of-freedom externally-powered prosthetic hands for persons with amputations proximal to the wrist. In the area of upper-limb control my research is directed towards the long-term goal of achieving meaningful, simultaneous, multi-functional, control of prosthetic arms and/or hands. This work is currently directed at developing physiologically appropriate microprocessor based controllers based on implantable “BION®-like” EMG sensors for multiple degree-of-freedom prosthetic arm control. My secondary research specialty area is the design and development of medical instrumentation. The current focus of which is the development of portable easy-to-use real-time gait analysis systems based on ultrasound ranging techniques. These systems, designed for use in small clinical facilities, record the instantaneous motion of a person's approximate body-center-of-mass for the purpose of measuring and diagnosing pathological lower-limb gait.

Selected Publications

Weir, R. F. ff., and Childress, D. S., (2001): Die Kineplastik zur Steuerung von

Fremdkraftprothesen. Medizinisch-Orthopädische Technik. No. 121, pp. 9 - 12, January.

Weir, R. F. ff., Grahn, E. C., and Duff, S. J., (2001): A New Externally-Powered, Myoelectrically Controlled Prosthesis for Persons with Partial Hand Amputations at the Metacarpals. Journal of Prosthetics and Orthotics. Vol. 12, No. 2, pp. 26 - 31, June 2001.

Weir, R. F. ff., Heckathorne, C. W., and Childress D. S., (2001): Cineplasty as a Control Input for Externally Powered Prosthetic Components. Journal of Rehabilitation Research and Development. Vol. 38, No. 4, pp. 357 - 363, July/August 2001.

Al-angari, H. M., Weir, R F. ff., Heckathorne, C. W., Childress, D. S., (2003): A Two Degree-of-Freedom Microprocessor Based Extended Physiological Proprioception (EPP) Controller for Upper Limb Prostheses. Technology and Disability, Vol. 15, No. 2, pp. 113 – 127.

Farrell, T. R., Weir, R. F. ff., Heckathorne, C. W., Childress, D. S., (2005): The Effects of Static Friction and Backlash on Extended Physiological Proprioception (EPP) Control of a Powered Prosthesis. Journal of Rehabilitation Research and Development. Vol. 42, No. 3, pp. 327-342, May/June 2005.

Ajiboye, A. B., and Weir, R. F. ff., (2005): A Heuristic Fuzzy Logic Approach To EMG Pattern Recognition for Multifunctional Prosthesis Control. IEEE Transactions on Neural Systems and Rehabilitation Engineering, Vol. 13, No. 3, pp. 280 – 291, September.

Dario, P., Hogan, N., Krebs, H. I., Rahman, T., Patton, J., van der Loos, H.F. M., Harwin, W. S., Childress, D. S., Weir, R. F. ff., (2005): The Past, Present and Future of Rehabilitation Robotics: An Ethical View from Pioneers of the Research. Industry/Research News, IEEE Robotics and Automation Magazine Vol. 12, No. 4, December, pp.92-95.

Sensinger J.W., and Weir, R. F. ff., (2006): Improved Torque Ripple Turning in Harmonic Drives through the Union of Two Existing Strategies. IEEE/ASME Transactions on Mechatronics, Vol. 11, No. 4, pp. 457-461, August 2006.

Lowery, M. M., Weir, R. F. ff., Kuiken, T. A., (2006): Simulation of Intramuscular EMG Signals Detected Using Implantable Myoelectric Sensors (IMES). IEEE Transactions on Biomedical Engineering, Vol. 53, No. 10, pp. 1926 – 1933, Oct. 2006.

Onishi, K., Weir, R. F. ff., Kuiken, T. A., (2007): Neural Machine Interfaces for Controlling Multifunctional Powered Upper-Limb Prostheses. Expert Reviews in Medical Devices, vol. 4, No. 1, pp. 43-53, 2007.

Farrell, T., and Weir, R .F. ff., (2007): The Optimal Controller Delay for Multifunctional Prostheses. IEEE Transactions of Neural Systems and Rehabilitation Engineering, Vol. 15, No. 1, pp:111 – 118, March 2007.

Ajiboye A. B., Bogey R. A., Weir R. F. ff., (2007) "Muscle synergies in the scaling of hand grasp forces". Journal of Neurophysiology (Submitted Oct 2007 - ID# JN-01119-2007).

Farrell, T. R. and Weir, R. F. ff., (2007) “Controller-Induced Delay Based on Analysis Window Attributes for Multifunctional Prosthesis Control,” IEEE Transactions on Neural Systems and Rehabilitation Engineering, (submitted: TNSRE-2007-00137.)

Ajiboye AB, Weir R. F. Ff. (2007) "Muscle synergies form a predictive framework for hand postures". Experimental Brain Research. (In preparation for Target Oct 2007.)

Sensinger, J. W. and Weir, R .F. ff., (2008). "User-Modulated Impedance Control of a Prosthetic Elbow in Unconstrained, Perturbed Motion." IEEE Transactions on Biomedical Engineering Vol. 55 No. 3 March 2008 pp: 1043-1055

Sensinger, J. W. and Weir, R .F. ff., (2008). "Modeling and Measurement of Rotational Stiffness in Trans-humeral Pseudarthrosis." IEEE Transactions on Neural Systems and Rehabilitation Engineering Vol. 16 No. 2 April 2008 pp: 184-190

Farrell, T. R. and Weir, R. F.,(2008) “A Comparison of Electrode Implantation and Targeting on Pattern Classification Accuracy for Prosthesis Control,” IEEE Transactions on Biomedical Engineering, Vol. 55, No. 9 Sept. 2008 pp: 2198-2211.

R. F. ff. Weir, P. R. Troyk, G. A. DeMichele, D. A. Kerns, J. F. Schorsch, H. Maas (2008):

Implantable MyoElectric Sensors (IMES) for Intramuscular Electromyogram Recording. IEEE Transactions on Biomedical Engineering, Vol. 56, No. 1 Jan. 2009