BIOGRAPHICAL SKETCH

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NAME	POSITION TITLE
Kobetic, Rudi, M.S.B.E.	Senior Biomedical Engineer
eRA COMMONS USER NAME (credential, e.g., agency login)	
RKOBETIC	

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	MM/YY	FIELD OF STUDY
Case Western Reserve University, Cleveland OH	B.S.	1977	Biomedical Engineering
Case Western Reserve University, Cleveland OH	M.S.	1980	Biomedical Engineering

A. Personal Statement

For over 30 years my professional effort has been dedicated to improving the lives and personal mobility of individuals paralyzed by spinal cord injuries (SCI), stroke or other disabling neurological conditions by means of functional electrical stimulation. I have focused on the biomechanics of stimulated muscle, the control of posture and gait and the construction of effective patterns of stimulation to restore or facilitate movement of paralyzed lower extremities with and without bracing. I have devised systems for delivering electrical stimulation to the key muscles and combine them with sensor based controllable bracing to enable walking and other maneuvers important for independence in veterans paralyzed from SCI. To further improve function of these systems, as part of the APT Center team I contributed significantly to the design, evaluation and ongoing development of a novel hybrid neuroprosthesis incorporating an advanced sensor-based controlled hip and knee mechanisms for walking in persons with paraplegia from SCI. The hybrid neuroprosthesis system was designed to reduce energy consumption by regulating posture through reciprocal coupling of the hips and stance phase knee flexion control during walking, to provide body weight support, adjust stimulation on a stride-to-stride basis, and restore stair ascent and descent function by controlling the resistance to knee flexion while lowering of the body during stair descent. This approach has the potential to significantly lower the energy requirement of walking and improve safety in terms of gait stability with lesser risk of falls in veterans disabled by SCI. I am committed to thoroughly evaluating the performance of the implanted hybrid neuroprosthesis that I have been instrumental in developing and applying the knowledge and techniques I helped create to understanding the long-term consequences of their application. I believe many individuals with complete paralysis from SCI can benefit from hybrid neuroprosthesis by improving their access to community and improve their quality of life. I manage the day-to-day technical components of the studies and work closely with engineers and clinical team members to ensure success. I assemble and conduct weekly meetings of team members to review status of study participants, to discuss progress and outcome measures and lead brainstorming sessions to optimize the study outcomes. As part of the *APT Center* team, I participate in collection and processing of data related to implanted hybrid neuroprosthesis reliability and the consistency of walking and stair function, conduct quantitative gait analyses and conduct all other activities necessary to determine the long-term effects of our implanted hybrid neuroprosthesis. I am an active member of the *APT Center* and I am excited about the possibility of improving our veterans' quality of life and looking forward to overcoming challenges that may come my way in this endeavor.

B. Positions and Honors

Positions and Employment

1980-Present Supervisory Biomedical Engineer, Motion Studies Laboratory, Veterans Affairs Medical Center, Cleveland, Ohio.

1979-1980 Research Engineer, Applied Neural Control Laboratory, Case Western Reserve University, Cleveland, Ohio.

1977-1978 Research Technician, Electronics Design Center, Case Western Reserve University, Cleveland, Ohio.

VA Committee Membership

2011-present LSCDVAMC Research and Development Committee
2008-present LSCDVAMC Subcommittee on Research Safety
2013-present LSCDVAMC BME Board

Other Experience and Professional Memberships

IEEE EMBS: Engineering in Medicine and Biology Society, Institute of Electrical/Electronics Engineers

Honors

Top 10 poster presentation at the 52nd annual APS conference, Sep 2006.

C. Selected Peer-reviewed Publications
Most relevant to the mission of the APT Center

1. Bulea TC, **Kobetic R**, Audu ML, Triolo RJ. Stance controlled knee flexion improves stimulation driven walking afterspinal cord injury. Journal of NeuroEngineering and Rehabilitation, 10:68, 2013.
2. Bulea TC, **Kobetic R**, Audu ML, Schnellenberger JR, Triolo RJ. Finite state control of a variable impedance hybrid neuroprosthesis for locomotion after paralysis. *IEEE Trans Neural Syst Rehabil Eng*. 2013 Jan;21(1):141-51. doi: 10.1109/TNSRE.2012.2227124. Epub 2012 Nov 15. PubMed PMID: 23193320
3. To CS, **Kobetic R**, Bulea TC, Audu ML, Schnellenberger JR, Pinault G, Triolo RJ. Sensor-based stance control with orthosis and functional neuromuscular stimulation for walking after spinal cord injury. *J of Prosthetics and Orthotics*, 24(3):124-132, 2012.
4. Bulea TC, **Kobetic R**, To CS, Audu M, Schnellenberger J, Triolo RJ. A variable impedance knee mechanism for controlled stance flexion during pathological gait. *IEEE/ASME Transactions on Mechatronics*, 17(5):822-832, 2012.
5. Bulea TC, **Kobetic R,** Triolo RJ. Restoration of stance phase knee flexion during walking after spinal cord injury using a variable impedance orthosis. *Conf Proc IEEE Eng Med Biol Soc*, 2011:608-11, 2011.
6. To CS, **Kobetic R**, Bulea TC, Audu ML, Schnellenberger JR, Pinault G, Triolo RJ. Stance control knee mechanism for lower-limb support in hybrid neuroprosthesis. *Journal of Rehabilitation Research & Development*, 48(7):839-850, 2011.
7. Audu ML, To CS, **Kobetic R**, Triolo RJ. Gait evaluation of a novel hip constraint orthosis with implication for walking in paraplegia. *IEEE Trans. Neural Syst Rehabil Eng*. 18(6):610-618, 2010.
8. **Kobetic R**, To CS, Schnellenberger JR, Audu ML, Bulea TC, Gaudio R, Pinault G, Tashman S, Triolo RJ. Development of hybrid orthosis for standing, walking, and stair climbing after spinal cord injury. *Jour Rehab Res and Dev* 46(3):447-462, 2009.
9. To CS, **Kobetic R**, Schnellenberger J, Audu M, Triolo RJ. Design of a variable constraint hip mechanism for a hybrid neuroprosthesis to restore gait after spinal cord injury. *IEEE/ASME Transactions on Mechatronics*, 13(2):197-205, 2008.
10. To CS, Kirsch RF, **Kobetic R**, Triolo R. Simulation of a functional neuromuscular stimulation powered mechanical gait orthosis with coordinated joint locking. *IEEE Trans Neural Sys and Rehab Eng,*13(2):227-235, June 2005.
11. **Kobetic R**, Marsolais EB, Triolo RJ, Davy DT, Gaudio R, Tashman S. Development of a hybrid gait orthosis: a case report. *J spinal Cord Medicine* 26(3):254-258, Fall 2003.
12. Agarwal S, Triolo RJ, **Kobetic R**, Miller M, Bieri C, Kukke S, Rohde L, Davis J. Long-term user perceptions of an implanted neuroprosthesis for exercise, standing, and transfers after spinal cord injury. J Rehab Res Dev 40(3):1-12, May/June 2003.
13. Triolo RJ, May QL, **Kobetic R**, Uhlir J. Selectivity of intramuscular electrodes in the lower limbs, *Jour Rehab Res and Dev* 38(5):533-544, 2001.
14. Marsolais EB, **Kobetic R**, Polando G, Ferguson K, Tashman S, Gaudio R, Nandurkar S, Lehneis HR. The Case Western Reserve University Hybrid Gait Orthosis, *J Spinal Cord Medicine* 23(2):100-108, 2000.
15. Ferguson KA, Polando G, **Kobetic R**, Triolo RJ, Marsolais EB: Walking with hybrid orthosis system, *Spinal Cord* 37:800-804, 1999

Additional recent publications (in chronological order)

1. Hardin EC, **Kobetic R**, Triolo RJ. Ambulation and spinal cord injury. *Phys Med Rehabil Clin N Am*. 2013 May;24(2):355-70. doi: 10.1016/j.pmr.2012.11.002. Epub 2013 Jan 21. PubMed PMID: 23598268.
2. Dutta A, **Kobetic R**, Triolo R. Walking after partial paralysis assisted with EMG-triggered or switch-triggered functional electrical stimulation--two case studies. *IEEE Int Conf Rehabil Robot*. 2011;2011:5975383. doi: 10.1109/ICORR.2011.5975383. PubMed PMID: 22275587.
3. Dutta A, **Kobetic R**, Triolo RJ. An objective method for selecting command source for myoelectrically triggered lower-limb neuroprostheses. *Journal of Rehabilitation Research & Development*, 48(8):935-948, 2011.
2. Foglyano KM, Schnellenberger JR, **Kobetic R**. Development of a self-contained accelerometry based system for control of functional electrical stimulation in hemiplegia. *Conf Proc IEEE Eng Med Biol Soc*, 2011:5448-51, 2011.
3. Stephanie Nogan Bailey S, Hardin EC, **Kobetic R**, Boggs LM, Pinault G, Triolo RJ. Neurotherapeutic and Neuroprosthetic effects of implanted functional electrical stimulation for ambulation after incomplete spinal cord injury. *Jour Rehab Res and Dev* 47(1):1-16, 2010.
4. Dutta A, **Kobetic R**, Triolo RJ. Gait initiation with electromyographically triggered electrical stimulation in people with partial paralysis. *Journal of Biomechanical Engineering* 131:0810021-0810029, Aug 2009.
5. Dutta A, **Kobetic R**, Triolo RJ. Ambulation after incomplete spinal cord injury with EMG-triggered functional electrical stimulation. *IEEE Trans Biomed Engr* 55(2):791-794, 2008.
6. Hardin E, **Kobetic R**, Murray L, Corado-Ahmed M, Pinault G, Sakai J, Nogan S, Ho C, Triolo RJ. Walking afert incomplete spinal cord injury using an implanted FES system: A case report. *Jour Rehab Res and Dev* 44(3):333-346, 2007.
7. Agarwal S, **Kobetic R**, Nandurkar S, Marsolais EB. FES for walking in paraplegia:17 year follow up of 2 cases. *J Spinal Cord Medicine,*26(1):86-91, 2003.
8. Nandurkar S, Marsolais EB, **Kobetic R**. Percutaneous Implantation of Iliopsoas for Functional Neuromuscular Stimulation, *Clin Orthop and Rel Res,*389:210-217, 2001.
9. Triolo RJ, Wibowo M, Uhlir J, **Kobetic R**, Kirsch R. Effects of stimulated hip extension moment and position on upper-limb support forces during FNS-induced standing- A technical note. *Jour Rehab Res and Dev* 38(5):545-555, 2001.
10. Uhlir JP, Triolo RJ, **Kobetic R**. The use of selective electrical stimulation of the quadriceps to improve standing function in paraplegia, *IEEE Trans Rehab Eng,* 8(4):514-522, Dec 2000.
11. **Kobetic R**, Triolo RJ, Uhlir J, Bieri C, Wibowo M, Polando G, Marsolais EB, Davis JA, Ferguson K, Sharma M. Implanted functional electrical stimulation system for mobility in paraplegia: A follow-up case report. *IEEE Trans Rehab Eng*, Dec 1999.
12. Kagaya H, Sharma M, **Kobetic R**, Marsolais EB. Ankle, knee, and hip moments during standing with and without joint contractures; Simulation study for Functional Electrical Stimulation. *Am J Phys Med Rehabil* 77(1):49-54, 1998.
13. Zhenxing J, **Kobetic R**. Rail supporting transducer posts for three-dimensional force measurement. *IEEE Trans Rehab Eng* 5(4):380-387, 1997.
14. **Kobetic R**, Triolo R, Marsolais EB. Muscle selection and walking performance of multichannel FES systems for ambulation in paraplegia. *IEEE Trans Rehab Eng* 5(1):23-29, 1997.
15. Triolo RJ, Bieri C, Uhlir J, **Kobetic R**, Scheiner A, Marsolais EB. Implanted functional neuromuscular stimulation systems for individuals with cervical spinal cord injuries: Clinical case report. *Arch Phys Med Rehabil* 77:1119-1128, 1996.
16. **Kobetic R**, Marsolais EB. Synthesis of paraplegic gait with multichannel functional neuromuscular stimulation. *IEEE Trans Rehab Eng* 2(2):66-79, 1994.
17. **Kobetic R**, Marsolais EB, Miller PC. Function and strength of electrically stimulated hip flexor muscles in paraplegia. *IEEE Trans Rehab Eng* 2(1):11-17, 1994.
18. **Kobetic R**. Advancing step by step. *IEEE Spectrum* 27-31, October 1994.
19. Marsolais EB, Sheiner A, Miller PC, **Kobetic R**, Daly JJ. Augmentation of transfer for a quadriplegic patient using an implanted FNS system. Case report. *Paraplegia* 32:573-579, 1994.
20. Doyle J, **Kobetic R**, Marsolais EB. Effect of Functional Neuromuscular Stimulation on Anterior Tibial Compartment Pressure. *Clin Orthop and Rel Res* 284:181-188, November 1992.
21. Marsolais EB, **Kobetic R**, Chizeck HJ, Jacobs J. Orthoses and electrical stimulation for walking in complete paraplegia. *Jour Neuro Rehab* 1(5):13-22, 1991.

22. Marsolais EB, **Kobetic R**, Barnicle K, Jacobs J. FNS application for restoring function in stroke and head-injury patients. *Jour Clin Eng* 15(6):489-496, December, 1990.
23. Carroll SG, Triolo RJ, Chizeck HJ, **Kobetic R**, Marsolais EB. Tetanic Responses of Electrically Stimulated Paralyzed Muscle at Varying Interpulse Intervals. *IEEE Trans Biomed Eng* 36(7):644-653, 1989.
24. Borges G, Ferguson K, **Kobetic R**. Development and Operation of Portable and Laboratory Electrical Stimulation Systems for Walking in Paraplegic Subjects. *IEEE Trans Biomed Eng* 36(7):798-801, 1989.
25. Marsolais EB, **Kobetic R**. Development of a practical electrical stimulation system for restoring gait in the paralyzed patient. *Clin Orthop* 233:64-74, 1988.
26. Chizeck HJ, **Kobetic R**, Marsolais EB, Abbas JJ, Donner IH, Simon E. Control of functional neuromuscular stimulation systems for standing and locomotion in paraplegics. *Proc IEEE* 76(9):1155-1165, 1988.
27. Marsolais EB, **Kobetic R**. Functional electrical stimulation for walking in paraplegia. *J Bone & Joint Surg* 69A(5): 728-733, 1987.
28. Marsolais EB, **Kobetic R**. Implantation techniques and experience with percutaneous intramuscular electrodes in the lower extremities. *Jour Rehab Res and Dev* 23(3):1-8, 1986.
29. Marsolais EB, **Kobetic R**. Functional walking in paralyzed patients by means of electrical stimulation. *Clin Orthop* 175:30-36, 1983.

Book Chapters

1. Nemunaitis G, Triolo R, **Kobetic R**, Kilgore K, Creasey G, Anthony DiMarco A. Spinal Cord Injury Medicine. Edited by S Kirschblum, D Campagnolo, J Delisa, et al.; Philadelphia, Pa. Lippincott, Wiliams & Wilkins. 2011. Chapter 25, Neuromuscular Electrical Stimulation in Spinal Cord Injury. p. 360-388.
2. Marsolais EB, Triolo RJ, **Kobetic R**, Nandurkar S. The Spinal Cord Injured Patient. 2nd ed. Lee BY, Ostrander LE, editors. New York: Demos; 2002. Chapter 16, The Role of Electrical Stimulation in Management of Spinal Cord Injured Patients; p.201-230. 432p.
3. Triolo RJ, **Kobetic R**, Betz RR. Human Motion Analysis. Harris GF, Smith PA, editors. New York, NY: IEEE Press; 1996. Chapter 17, Standing and Walking with FNS: Technical and Clinical Challenges; p.318-350.
4. **Kobetic R**, Marsolais EB, Semame P, Borges G. Human Walking. 2nd ed. Rose J, Gamble JG, editors. Baltimore, Maryland, USA: Williams & Wilkins; 1994. Chapter 10, The Next Step: Artificial Walking; p.225-263.

D. Research Support

Ongoing Research Support

B7692R (Principal Investigator) 10/13-9/16
Department of Veterans Affairs "Improving Ambulatory Community Access after Paralysis"
The objective of this feasibility study of safety and effectiveness of an implanted multichannel functional electrical stimulation (FES) gait system is to correct gait instability and increase walking speed to improve ambulatory community access of persons with lower extremity paralysis due to incomplete spinal cord injury.

B0608-R (Principal Investigator) 1/13-12/16
Department of Veterans Affairs "Hybrid Neuroprosthesis with a Variable Knee for Walking in SCI"
The objective of this study is to determine whether a novel hybrid neuroprosthesis combining functional neuromuscular stimulation and incorporating an advanced sensor based controlled variable impedance knee mechanism for walking in persons with paraplegia from spinal cord injury can: 1) reduce impact forces during loading, improve forward momentum, reduce the fluctuations in vertical trunk motion, and improve foot-ground clearance during walking, and 2) restore stair descent and stand-to-sit functions by controlling the resistance to knee flexion while lowering of the body.