

Cleveland State University

EngagedScholarship@CSU

Undergraduate Research Posters 2014

Undergraduate Research Posters

9-4-2014

Electronic Control Optimization of a Regenerative Leg Prosthesis

Taylor Barto

Cleveland State University

Dan Simon

Cleveland State University, d.j.simon@csuohio.edu

Follow this and additional works at: https://engagedscholarship.csuohio.edu/u_poster_2014



Part of the [Engineering Commons](#)

[How does access to this work benefit you? Let us know!](#)

Recommended Citation

Barto, Taylor and Simon, Dan, "Electronic Control Optimization of a Regenerative Leg Prosthesis" (2014). *Undergraduate Research Posters 2014*. 3.

https://engagedscholarship.csuohio.edu/u_poster_2014/3

This Article is brought to you for free and open access by the Undergraduate Research Posters at EngagedScholarship@CSU. It has been accepted for inclusion in Undergraduate Research Posters 2014 by an authorized administrator of EngagedScholarship@CSU. For more information, please contact library.es@csuohio.edu.



Electronic Control Optimization of a Regenerative Leg Prosthesis

Washkewicz College of Engineering

Student Researcher: Taylor Barto

Faculty Advisor: Dan Simon

Abstract

Until recently, leg prostheses (artificial legs) operated similarly to a leg without muscles. With recent advances in electronic technology, motorized prostheses have become possible. However, these prostheses require large batteries and have a limited operation time. Our research focuses on using supercapacitors in prostheses to exploit the braking portion of human walking to regenerate energy, thus reducing the dependence on batteries. To use supercapacitors with the knee motor, electronic control circuitry is required. We are using a circuit that is similar to a standard motor controller to manage the flow of energy between the supercapacitor and the knee motor. This circuit can operate in two primary modes: one mode during motoring, and another mode during braking. Two additional, secondary modes arise depending on the direction the knee is rotating. Real-time switching between these four modes allows the prosthesis to correctly power the motor, and to maximize energy storage during braking. The prosthesis characteristics are optimized with artificial intelligence algorithms. Due to the large amount of computational effort required, the optimization algorithm is performed with parallel computing.