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# Power Electronics Design for a Transfemoral Prosthesis

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## Abstract

Prosthetic legs do not always properly emulate a human leg. However, recent advances have allowed prostheses to include motors and brakes in order to closely mimic the performance of human legs. Unfortunately, motorized prostheses are often inefficient, which results in a dependence on batteries. This project aims to use energy regeneration methods to increase the operating time of motorized prostheses. Regeneration occurs when the leg requires braking; instead of using an energy-wasting braking mechanism, energy flows through an electronic circuit into a bank of supercapacitors. The energy can also flow in the reverse direction so that the motors can be powered by the supercapacitors when the prosthesis needs positive energy. In this research, the flow of energy is regulated by two different control methods which are compared through computer simulations. The physical component values and control parameters are optimized with two different evolutionary algorithms using a low-fidelity simulation. Results from the simulations are analyzed so that the electronic circuitry can be integrated into a higher fidelity simulation that includes a mechanical model of a transmission and friction.