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Development and Implementation of Energy-Efficient Magnetorheological Fluid Bypass Damper for Prosthetics Limbs Using a Fuzzy-Logic Controller
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Abstract
Walking behaviour in amputees with lower-limb loss is absent from shock-absorbing properties. A damper can be used to reduce the impact of ground reaction force (GRF) during heel strikes. Magnetorheological fluid (MRF) damper is deemed the best option for this application as it includes the advantages of both passive and active dampers. An enhanced MRF damper is essential in supplying the appropriate current and damping force levels. Therefore, an energy-efficient design is required to prolong the battery life used by MRF dampers in prosthetic limbs. This paper investigates two fluids of different properties and magnetic particle volume content. A bypass damper was used to observe the response of both fluids. The findings highlighted that an MRF with a higher percentage of solid weight could produce a more significant damping force with a lesser amount of applied current. This work presents a simulation study on implementing the energy-efficient MRF damper utilizing a Fuzzy-PID controller in a prosthetic limb. © 2013 IEEE.

Author Keywords
Energy efficiency; magnetic particle ratio; magnetorheological fluid; prosthetic limb; shock absorption

Index Keywords
Artificial limbs, Biophysics, Damping, Fuzzy logic, Magnetism, Magnetorheological fluids, Pistons, Shock absorbers, Three term control systems; Magnetic liquids, Magnetic particle, Magnetic particle ratio, Magnetic-field, Magneto-mechanical effects, Particle ratios, Prosthetic limbs, Shock absorption; Energy efficiency

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