Simulation and Control of an Intelligent Prosthetic Knee with Biogeography-Based Optimization

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Simulation and Control of an Intelligent Prosthetic Knee with Biogeography-Based Optimization

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Abstract

Traditional, passive leg prostheses for transfemoral amputees require the user to produce unnaturally large actuations in order to walk. The resulting motions can cause joint degeneration and arthritis. To avoid this, a semi-active prosthetic knee using hydraulics to store and release energy has been developed. This prosthesis can potentially reduce the compensative forces and torques that the user must supply at the hip. The hydraulic knee actuator of this prosthesis is controlled using electronic valves, and the nonlinear nature of human body dynamics means that it is difficult to control these valves to achieve gait. Because of the nonlinearity of this system, this problem is well suited to tuning with biogeography-based optimization (BBO). In our work this summer, we have improved upon a previous simulation model for this leg, and we have developed preliminary valve control results in this simulation software with BBO.