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Correcting Reaching Movements Using Force Sensors and Robot Simulation

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Abstract

People who have suffered high spinal cord injuries are unable to move their limbs. Functional electrical stimulation (FES) activates paralyzed muscles by electrical current and is a way to restore some function to a paralyzed arm. This research was conducted to develop a way for a caregiver to correct reaching movements to a person with paralyzed arms. We asked participants to take part in this study to help obtain data to test the learning feedback system. We represented a paralyzed arm with a Barrett Medical Proficio robot. The robot is programmed to reach out and purposely miss a target. The participant then moves the robot arm during a second reach to correct the reaching movement in order to hit the intended target. While moving the robot's arm, we record the forces required to move the arm to reach its intended target. With the data collected by the force sensor, we were able to calculate new joint torques from the applied forces and program the robot arm to move to the correct position using those joint torques. These results show promise for developing an adaptive feedback system to correct reaching movements for use with FES systems for people with paralyzed arms.