“Development of Haptic Feedback Devices for Upper Limb Amputees”

Andrew Erwin
Faculty Mentor: Professor Frank Sup, Mechanical Engineering

With the advent of myoelectric prostheses in the 1960s, amputees have been able to utilize their prostheses better than ever before. However, while the devices allow the amputee’s efferent commands to control the device, they do not relay the necessary afferent signals back for proprioceptive information. This results in consuming the amputee’s visual attention in order to determine where the prosthesis is in relation to the rest of the body. To make prostheses more natural for amputees, haptic feedback is required. Many attempts have been made to create a prosthesis that incorporates haptic feedback, but no true haptic feedback prosthesis has been commercialized. Methods to develop haptic feedback have been to use vibrating motors, voice coils, and heat to stimulate proprioception on the amputee’s residual limb.

The goal of this REU is to further the development of a device developed in the lab by a previous undergraduate student as well as designing, fabricating and experimenting with a new haptic feedback device. Possible design changes to the device currently in the lab could include using different end effectors by varying its size, shape and material. The other goal would be to design a new experimental protocol using an EMG test setup, as well as writing an IRB for the experiment. The new design will have multiple magnet and coil systems that wrap around the upper or lower arm, providing feedback in 3-dimensional space. This would serve to create pressure gradients for static feedback and pressure waves for kinesthetic feedback, allowing for more advanced and realistic haptic feedback from the device. EMG testing, along with other experiments, will be used if time allows for the testing of the device.