Thermally Actuated Artificial Muscles for Use in Exoskeletons

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The purpose of this project was to explore the properties of various types of thermally actuated artificial muscles that could be used to make exoskeletons. Using thermally actuated artificial muscles would decrease cost, weight, and noise of wearable orthotic devices. The exoskeleton would use electrically heated twisted and coiled polymer fishing line or some type of Shape-Memory Alloy (SMA), specifically nitinol. Research was done on how to make and use twisted polymer fishing line and nitinol actuators. Dozens of actuator and lever prototypes were made. Based on the results from those prototypes an exoskeleton leg was developed. Results showed that actuators made with thermally actuated artificial muscles are lighter weight, less expensive and quieter compared to other traditional methods of making actuators. Traditional methods allow for stronger actuators through gearing and also allow for more strength by using higher pressures within their actuators. Testing of the nitinol showed its remarkable strength which could be used successfully in an exoskeleton.

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