Parkinson's Disease Tremor Reduction Device

Mechanical Engineering

Students: Tim Enserink, Alex Rodriguez, Tyler Wigert, Derek Lin, Kevin Mifflin
Advisor: Dr. The Nguyen

FRESNO STATE
Lyles College of Engineering

Abstract

Parkinson's disease is a chronic progressive neurological disorder that affects more than ten million people worldwide. Parkinson's disease is caused by a shortage of dopamine producing cells which allows the brain to transmit signals. The most common side effect of the lack of dopamine is tremors. The tremors can be characterized by a postural or as a kinetic tremor. Unfortunately, there is no known cure for this neurological disorder. The only thing that can be done is to manage the symptoms.

Our project revolves around trying to create a vibration damper to limit the tremors in the hands. The device being developed uses a mass and spring system mounted inside a bracelet to absorb the vibrations of a tremor. The device will be a relatively inexpensive solution to reducing tremors and will allow the user to be able to perform everyday tasks that require a steady hand.

Specifications

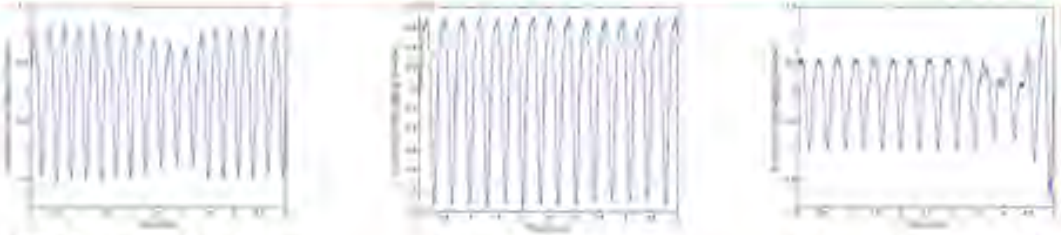
In order for us to test our project, we need to be able to have a stable constant hand motion for us to study the frequency and motion. To test out these specific conditions, we need to build our own testing apparatus to oscillate a test hand and mass. In order to simulate what tests we need done, we had to research and study the human body's average tremor frequency, dimensions, and weight. Tremor frequency ranges between **3 – 7 Hz**. The weight of the hand and forearm is an average of 2.26% of total body weight.

- Tremor Frequency used: 3 Hz
- Average Wrist Circumference: 6.8125 inches
- Weight of hand + forearm of a 150 pound man used: **3.36 pounds**

Overview

The design of the Parkinson's tremor bracelet is based on concepts from **vibration absorption**. If tuned to the correct tremor frequency and the weight of the patients arm, the tremor will be diminished or eliminated by the spring-mass system in the bracelet.

Testing Results



Without Weight | With Weight | With Bracelet

Conclusion

- Acceleration reduction: Without weight vs. With passive weight → 58%
- Acceleration reduction: With passive weight vs. With bracelet → **24%**
- Bracelet weight: less than 1 lb
- Cost to make: less than $500
- Only address tremor, not affect other motions of the arm

2016