Automating Anti-Vibration Glove Testing following ISO 10819

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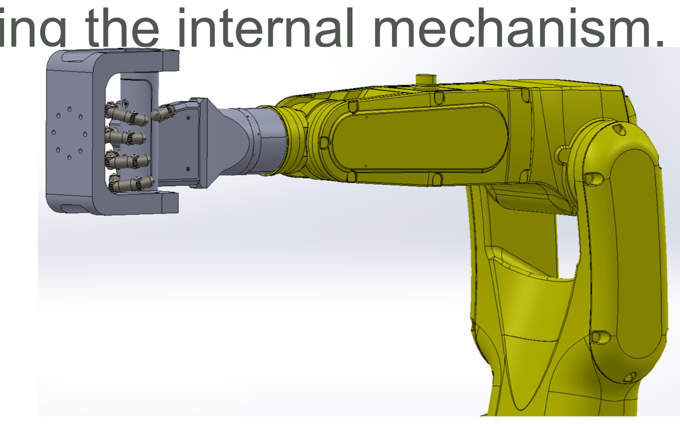
Abstract

The goal of this project is to Automate anti-vibration glove testing procedure by creating a Biodynamic Artificial mechanical hand. The hand is capable of exerting and maintaining at least 40 Newtons of grip force inside a variety of anti-vibrational gloves while griping a 2-inch rod mounted on a dynamic shaker. The development of this artificial hand can lead to continuous testing and data collection creating ideal assessments of the gloves while eliminating human testing currently used in industry.

Introduction

The Project proposed by Dr. Peterson Involves creating a biodynamic mechanical hand, designed for anti-vibration glove certification using ISO 10819 standard. The Mechanical hand is mounted on a FANUC LR mate 200ic used to maneuver the hand onto a dynamic shaker while engaging the internal mechanism.



The artificial hand will be capable of exerting between 40-90 Newtons of grip force ensuring the gloves material and design are thoroughly tested and scrutinized. The automation of this process can lead to the elimination of human testing, while introducing a constant parameter, making it possible to rate gloves against one another creating a gold standard.

Methods and Materials

Material

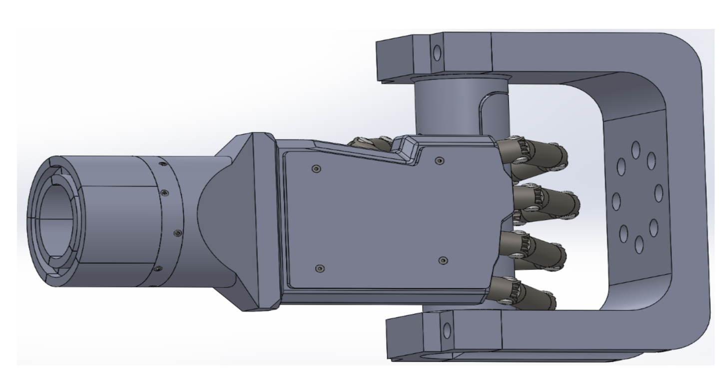
- Aluminum 6061
- Resin Film
- Compression springs
- Braided Cable

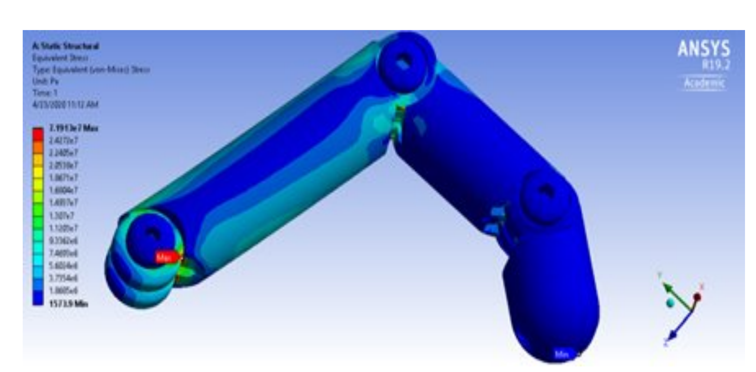
Methods

- 3D printing of complex components within the NIU Makerspace.
- NIU Machine shop for the simple metallic components such as the palm and sleeve.
- E-Machine shop for the complex metallic components such as the fingers.
- Ansys simulation

Results

As a presumption of the initial design, the interlocking joint flanges proved to present the maximum stress concentration of 71.9 MPa. With a material yield limitation of 290 MPa, the static loading conditions are more than sufficient. As physical testing is underway, or a more prolific vibratory analysis is undertaken, this large void under that of material plasticity will act as a buffer to counter potential project redesign. Occurring deformations were deemed insignificant to the context of the project but warrant further investigation during the next phase of this project administering physical testing.





Discussion

Vibratory testing, in the theoretical sense, would be largely founded without reasonable data driving a computational simulation thus it was applicable to use static analysis to drive the spring selections that dictate resistances that relate the developed motion of the hand assembly to the subjected loading metrics used during testing. Each element of the hand assembly asserts realistic design concepts alongside a demand to narrow the sight of future project limitations.

Conclusions

The designed biodynamic hand embodies key aspects of the idealized hand design sought after in the initial design phase of the project. This includes being highly simplistic, easily adjustable throughout the testing phase, and limiting specific dimensions of the hand for the application of tissue. The nature of this project aims for continued development over a significant time period thus providing the basis for negating possible cosmetic considerations.

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