The University of Texas at TYLER

TYL 02

Dept. of Mechanical Engineering

Understanding the Internal Forces on Post Operation Implants Using the Hip Joint Motion Simulator

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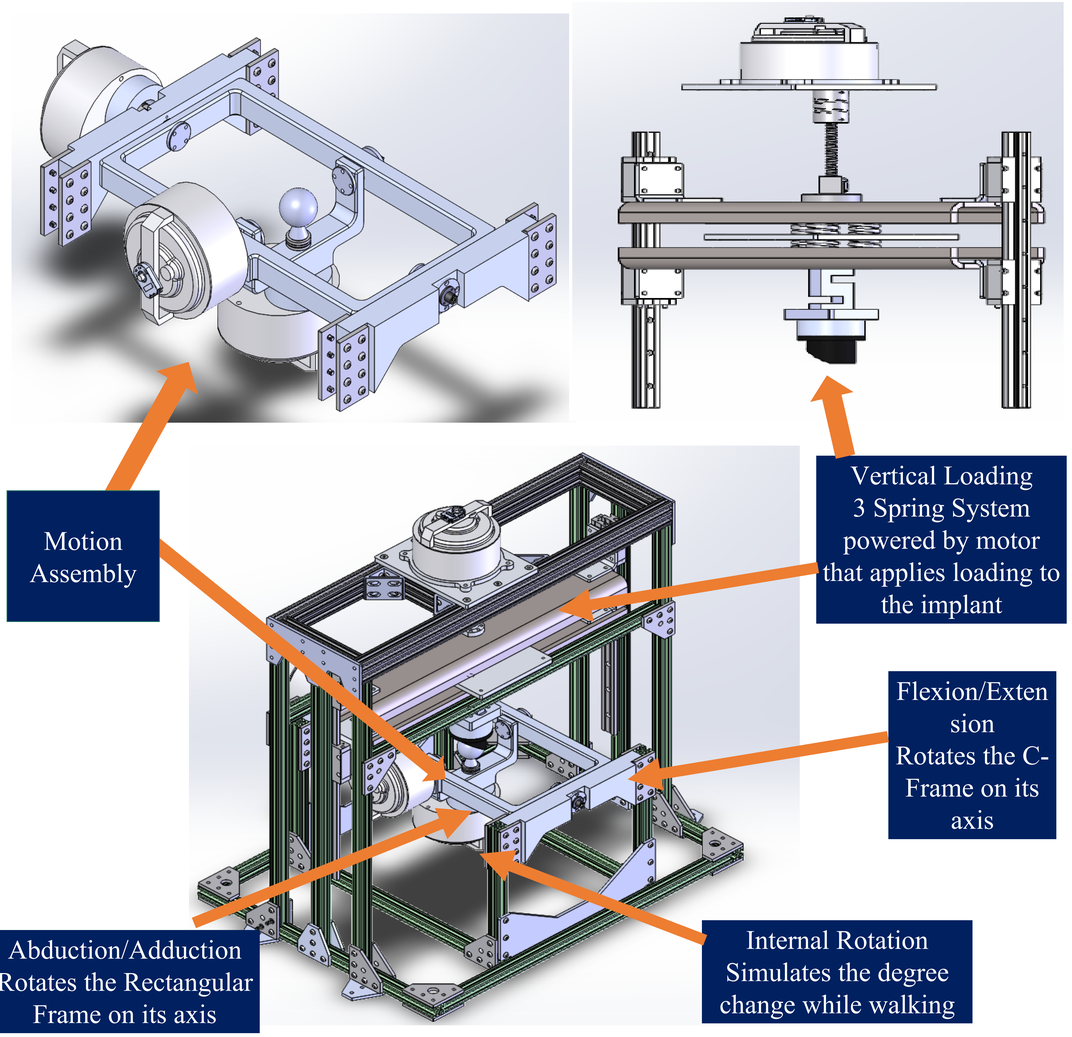
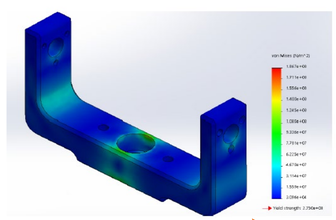


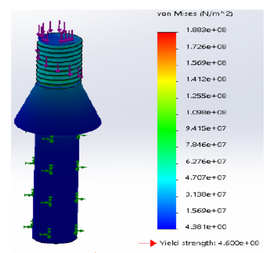
Background

Designed Hip Joint Simulator will be used with a user provided Energy Harvester to be a testing apparatus for the Mechatronics and Energy Harvesting Laboratory located at the University of Texas at Tyler

Specifications

Specification	Values/ Limits	Units
Machine simulated include 3DOFs	3	DOF
Requires Maximum Vertical load	2000-3000	Newtons
Frequency range of simulated motion	0.5-5	Hz
Simulator apply normal range of hip motion	Flexion: 0-75 Extension:0-75 Abduction:0-40 Adduction:0-35 Internal rotation: 15-345	Degrees





FEA of C-Frame
Material :Al 6061
Applied Force :4800 N
Safety Factor : 1.5

FEA of internal rotation shaft
Material: 4130 Steel
Applied force: 4800N
Safety Factor: 2.1

Abstract

The designed hip joint simulator will be able to simulate 3 degrees of freedom which consists of abduction/adduction, internal rotation and flexion/extension motion. The hip joint simulator supports vertical loading assembly which helps to provide the data for amplitude and frequencies of the cyclic gait motion. The final prototype of the machine will be implemented with the energy harvester device which can be used as a testing apparatus to the Mechatronics Lab at The University of Texas at Tyler.

Objective

1. Simulate 3 Degrees of Freedom and hip joint movements of human walking activity
2. User-programmable to control the loads, amplitudes, and frequencies applied
3. Record accurate measurements

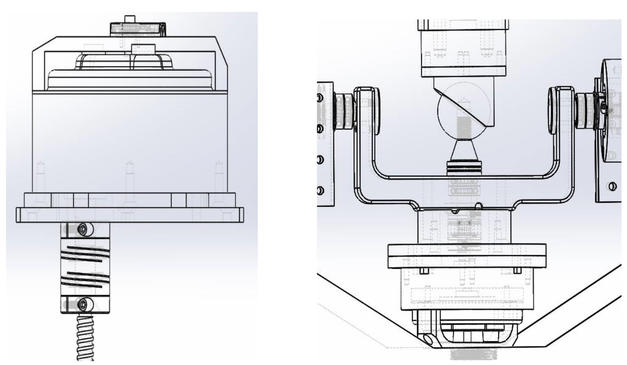
Future Plans

The next steps consist of finalizing the Vertical loading system setup. After this, building and testing procedures will be performed to ensure all specifications are met.

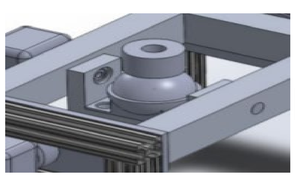
Conclusion

Through Research and Analysis, this design has changed to better meet specifications. After testing the final design will then be chosen that provides 3 DOF and hip joint movements, User controlled loads, amplitudes, and frequencies, and record accurate measurements.

Top Motor Section and Internal Rotation View

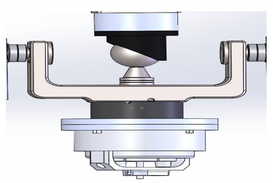


Stages



C-Frame Design without Internal Motor

- Design was referenced by Penn State Knee Joint Simulator Design
- Didn't provide Internal Rotation



Design with Internal Motor

- Provides Internal Rotation
- Along with C frame Provides all 3 DOF

Key Decisions

- Use of 3 spring Vertical Load System
- Added Motor for internal Rotation
- User Programmable

Acknowledgements

- Dr. Chung Hyun Goh – Faculty Advisor
- Dr. Alwathiqbellah Ibrahim – Sponsor
- Dr. Barakat – Chair of Mechanical Engineering
- Sat- Life Technologies – Volunteer Sponsor