Simulation of Pyrotechnic Shock

Team 12: Luis Lopez, Max Mecabe, Tiffany Shaw, Justin Vigo, Sarah Wyper

Background and Introduction

- Pyrotechnics are used for tasks such as rocket separation, pilot ejection, and airbag inflation.
- Can be damaging to electronic hardware.
- Actual pyrotechnics are not required to simulate similar shock response.
- Shock is modeled on Shock Response Spectrum (SRS) curve.
- The curve models the system as an array of single-degree-of-freedom systems

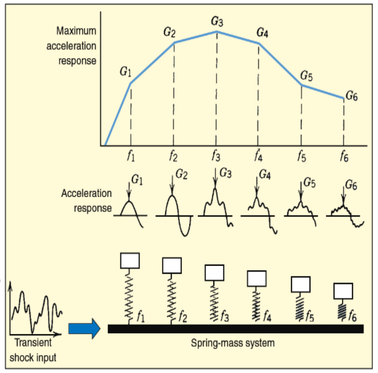

Fig. 1- Example of SRS and spring-mass systems relationship

Need Statement: Optimize the test device's stability and repeatability and in turn develop a better understanding of relations between various text fixture parameters and resulting SRS curves.

Project Goals:

1. Modify design to create repeatability in results
2. Systemize and correlate variables to specific SRS curves in outputs
3. Possibly improve efficiency of data acquisition process

Last Year's Work

Fig. 2- Test Rig

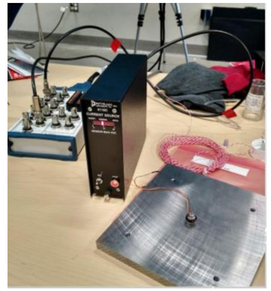

Fig. 3- Data Acquisition System

This Year's Progress

Anchoring:

- Newport Series Optical Instrumentation Table
- 4 Aluminum Two-Hole Cable Straps with foam

Fig. 4- Test Device with Cable Straps

Fig. 5- Before Anchoring

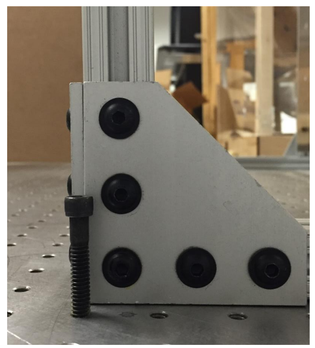

Fig. 6- After Anchoring

Swinging Pivot:

- 80/20 Inc. Dynamic pivot with bronze bushings

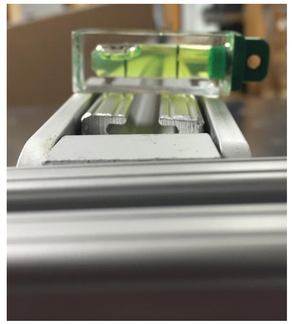

Fig. 7- Un-centered static pivot

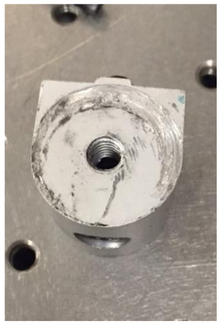

Fig. 8- Worn Static Pivot

Fig. 9- Attached Dynamic Pivot

Future Work

To further improve repeatability of test device, the next step is to decouple the strike plate from the frame using a tethered design. This also involves designing a new strike plate, with additional holes for more variability and a smaller sacrificial plate.

Fig. 10- Tethered Design

Afterwards, plans include:

1. Verifying repeatable results can be made
2. Experimenting with changing parameters, collecting shock response data, and generating new SRS curves
3. Identifying how to tune fixture to achieve desired SRS curves
4. Abaqus modeling of stress locations