Simulation of Pyrotechnic Shock

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Background and Introduction

- Pyrotechnics are used for tasks such as rocket separation, pilot ejection, and airbag inflation.
- 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
- Test device built by Senior Design Team 15 last year

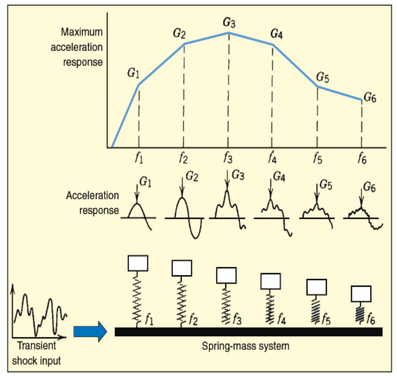

Fig. 1- SRS Curve Generation

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

Fig. 2- Test Device Built Last Year

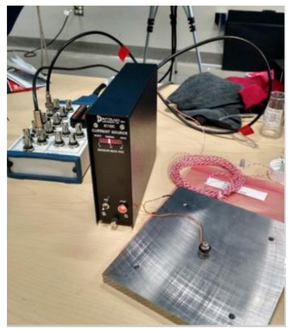

Fig. 3- Data Acquisition System

Repeatability Improvements

Improvement Action	Reasoning
Anchoring	Stabilization
Dynamic Pivot	Striking Consistency
Grounding of DAQ	Elimination of Noise
Rubber Pads at L-brackets	Decoupling Frame and Plate
Sacrificial Plate Removal	Eliminate Noise from Plate Separation
Direct Accelerometer Mounting	Eliminate Damping Affecting High Frequency Data

Fig. 4- Before Anchoring

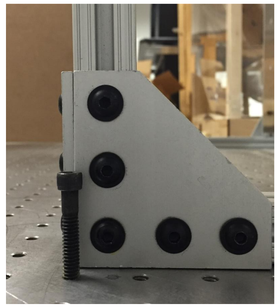

Fig. 5- After Anchoring

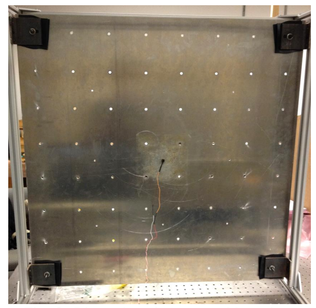

Fig. 6- Direct Accelerometer Mounting

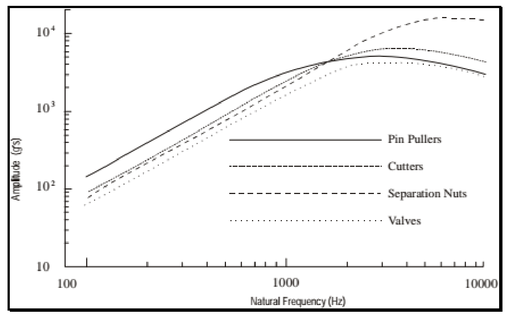

Fig.7- Ideal SRS Repeatability Standards

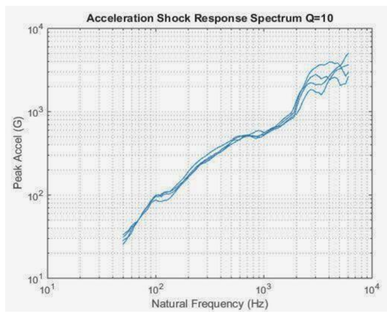

Fig. 8- SRS, Initial Repeatability

Variable Testing

- Nine Variable Locations
- Test 1: Change Strike Location Only
- Test 2: Change Accelerometer Location Only

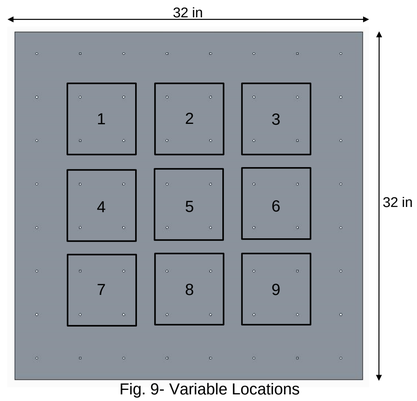

Fig. 9- Variable Locations

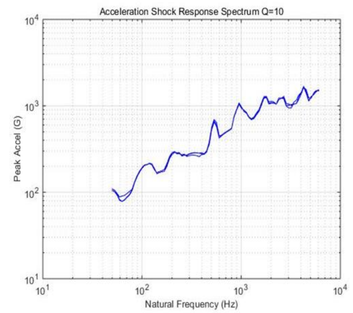

Fig. 10- SRS, Strike Location 4

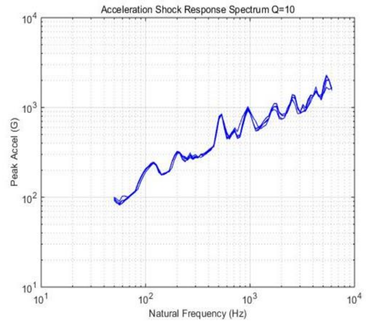

Fig. 11- SRS, Strike Location 6

Conclusions and Future Work

1. Attach electromagnet to further improve hammer release mechanism
2. Continue variable testing, changing accelerometer location next.
3. Identify trends and variables that affect specific aspects of SRS curves