

Pyrotechnic Shock Modeling

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Outline:

- Project Background
- New Developments
- Summary
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- Future Work
- Questions



Project Background:

This project requires collaborative effort in order to re-design and produce a suitable testing apparatus and modeling system for pyrotechnic shock testing.



Background Details

Pyrotechnic Shocks

- High Frequency
- High Acceleration
- Short Duration
- Transient Response

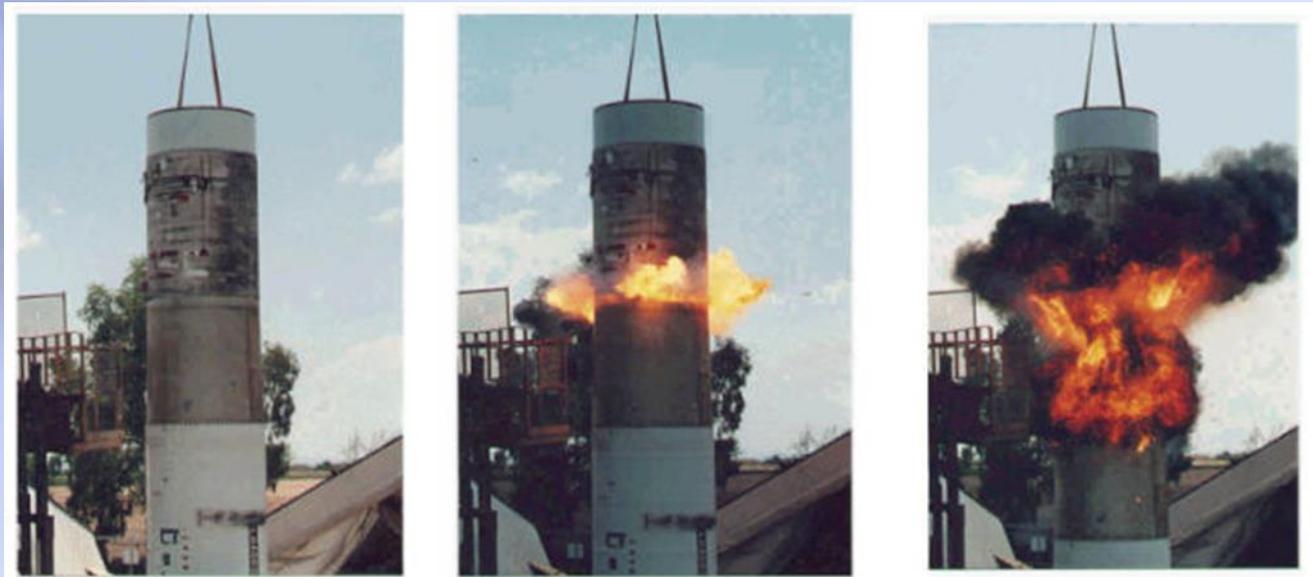


Figure 1. Pyrotechnic Devices are used for stage and fairing separation in launch vehicles.

Project Details

- Shock Response Spectrum (SRS)
- Does not require actual pyrotechnics to create
- Analytical and experimental modeling

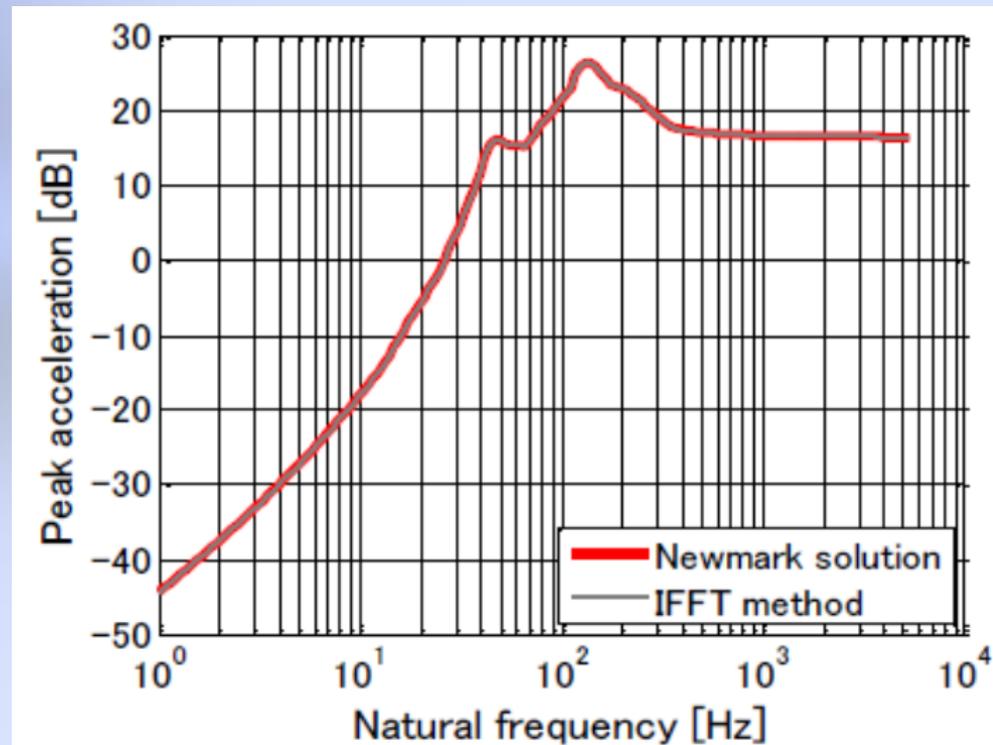


Figure 2. An example Shock Response Spectrum (SRS)

New Developments

- Extension from 1 year project to 2 years
- Decreased Project scope per year
- Increased focus in 2014-2015 on test fixture and tuning

Apparatus	Accuracy	Durability	Assembly	Cost	Adaptability	Total
Midterm 1 Weight Factor	0.30	0.15	0.15	0.20	0.20	1.0
Suggested New Weight Factor	0.30	0.10	0.10	0.20	0.30	1.0

Table 1. Decision matrix for determining shock generator; changes displaying redefined focus for Harris Pyrotechnic Shock Testing project.

Method of Shock Generation

- Higher force levels:
 - Shock Tube, Hydraulic/ Air Pneumatic Hammer
- New focus requires less force:
 - Drop Hammer



Figure 3. Example of a drop hammer for shock testing

New Developments

- Software tools being used
 - MATLAB
 - Creo Simulate
 - MSC Nastran or ANSYS
- Test Fixture Adjustments
 - Stiffening, damping, mass location
 - Shock absorption, and hammer shape
 - Fixture shape variations

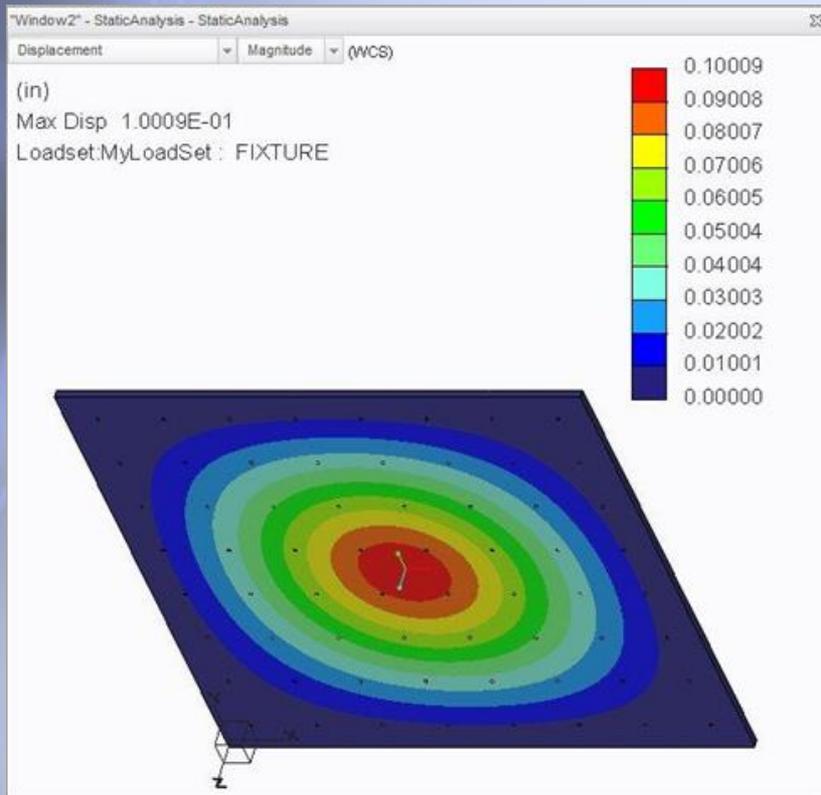


Figure 2. An FEM Structural Analysis for a static plate being struck (1500lbf point force at center of plate)

Modeling & Simulation



Video demonstrating the formation of modes caused by sound vibration emanating from the center radiating to the edges of a rectangular plate.

Plan of Action

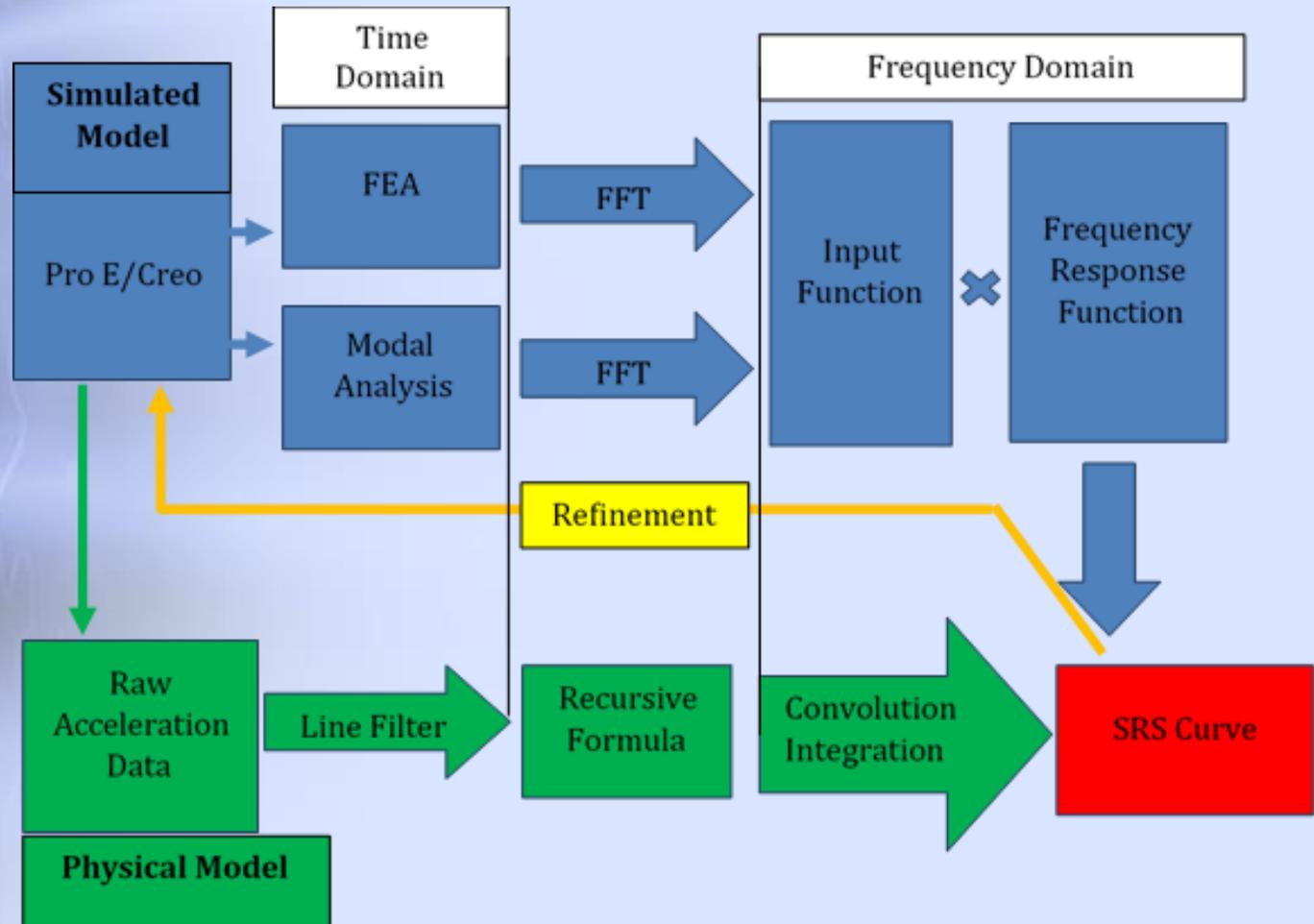


Figure 4. Flow chart showing the processing of both analytical and experimental shock data

Gantt Chart

22	1.6	Development
23	1.6.1	Dimension & Physical setup
24	1.6.2	Test Apparatus Selection
25	1.6.3	Material Selection
26	1.6.4	Preliminary CAD Drawings
27	1.6.5	Modeling
28	1.6.5.1	FEM Modeling
29	1.6.5.1.1	Structural Simulations
30	1.6.5.1.2	Modal Simulations
31	1.6.5.1.3	Frequency Domain Simulations
32	1.6.5.2	Force Generation
33	1.6.5.3	Response Spectrum Generation
34	1.6.5.4	Program Development
35	1.7	Procurement
36	1.7.1	Pneumatics
37	1.7.2	D.A.Q
38	1.7.3	Structural
39	1.7.4	Submit Purchase Orders

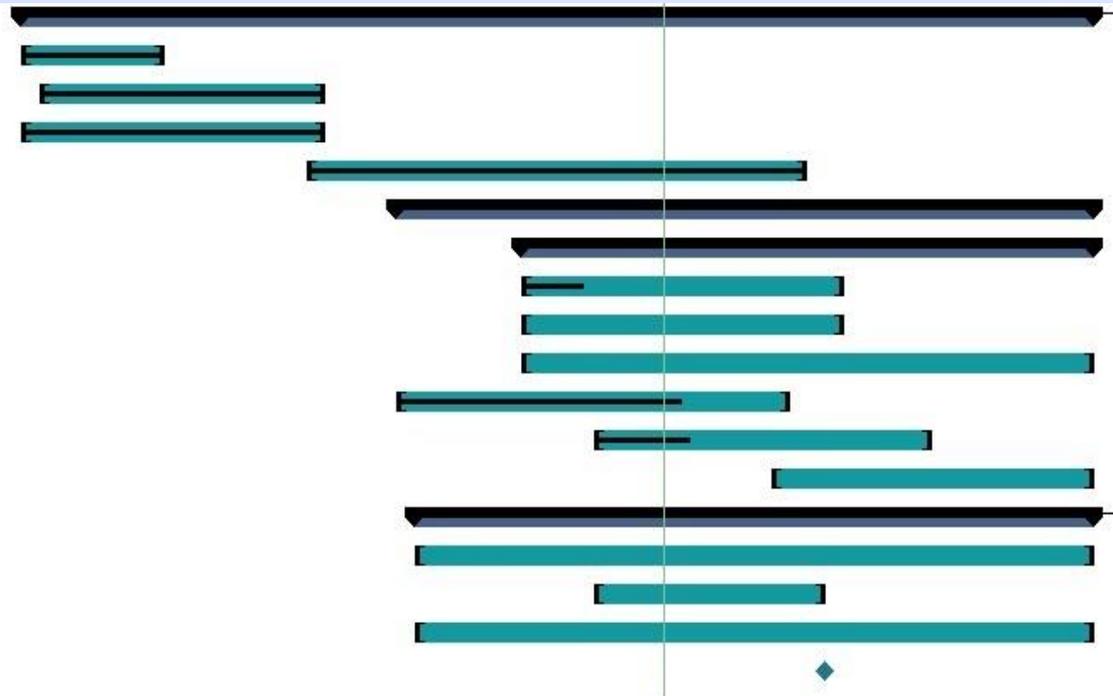


Figure 4. New Gantt Chart reflects changed to scope and focus taken from teleconference with Harris [Nov. 15 – Dec. 5]

Summary

- Pyroshock difficult to recreate
- Can be simulated by other means
- Resultant SRS curve depends on many variables
- Project scope and focus has changed to place an emphasis on adaptability and tuning
- Goal to systemize and correlate variables to specific SRS curve outputs

References

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- [5] DeMartino, Charles, Nathan Crisler, Chase Mitchell, and Chad Harrell. *Pyrotechnic Shock Test Development - Midterm I Report*. Tech. no. 1. Tallahassee: FAMU-FSU College of Engineering, 2014. Print.
- [6] Wells, Robert. "Conference Call with Mr. Wells, Mrs. Cooper, and Mr Cornejo." Teleconference interview. 13 Nov. 2014.
- [7] Walker, Clint. "The Art Of Sound." *YouTube*. YouTube, 6 May 2006. Web. 19 Nov. 2014.

Questions?



Additional information about our project can be found on our team's website:

http://eng.fsu.edu/me/senior_design/2015/team15/