



Dr. Daniel Wendichansky Dynamics Experiential Module Education and Outreach

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Background:

The idea for the Dynamics Experiential Education Module was first considered by Dr. Daniel Wendichansky, for many years the Director of the Structures Laboratory. The concept was to create a “seismic chair” where the students or community could seat and buckle in to experience dynamic loads from sinusoidal to random motion (earthquake loads). This concept was modified and built for an undergraduate research course for two Mechanical Engineering students Jonathan J. Lopez Badillo and Sebastian Rivera-Mongil, accompanied by Civil Engineering students Elmer Irizarry, Kelvin Filippetti and Austin Vega, supervised by Dr. M. Cortes Delgado.



Figure 1. Test Subjects Experiencing Dynamic Loads on the “Seismic Chair”

Methodologies:

- A rigid chair was designed using Siemens NX11, able to withstand the different dynamic loads applied.
- Two chairs were constructed, and buckles were added to secure the passengers in place.
- The servo-hydraulic shake table was calibrated both without the chairs and with the chairs attached.
- Simulations were divided into 5 categories: Sine Waves, Ramp Waves, Square Waves, Random Waves (historical earthquake records) and Wind Reactions (recorded during Hurricane María)
- People from the community and UPRM students were invited to participate in the activity, where they received a brief introduction to structural dynamics before buckling in the seats to experience the different dynamic loads.

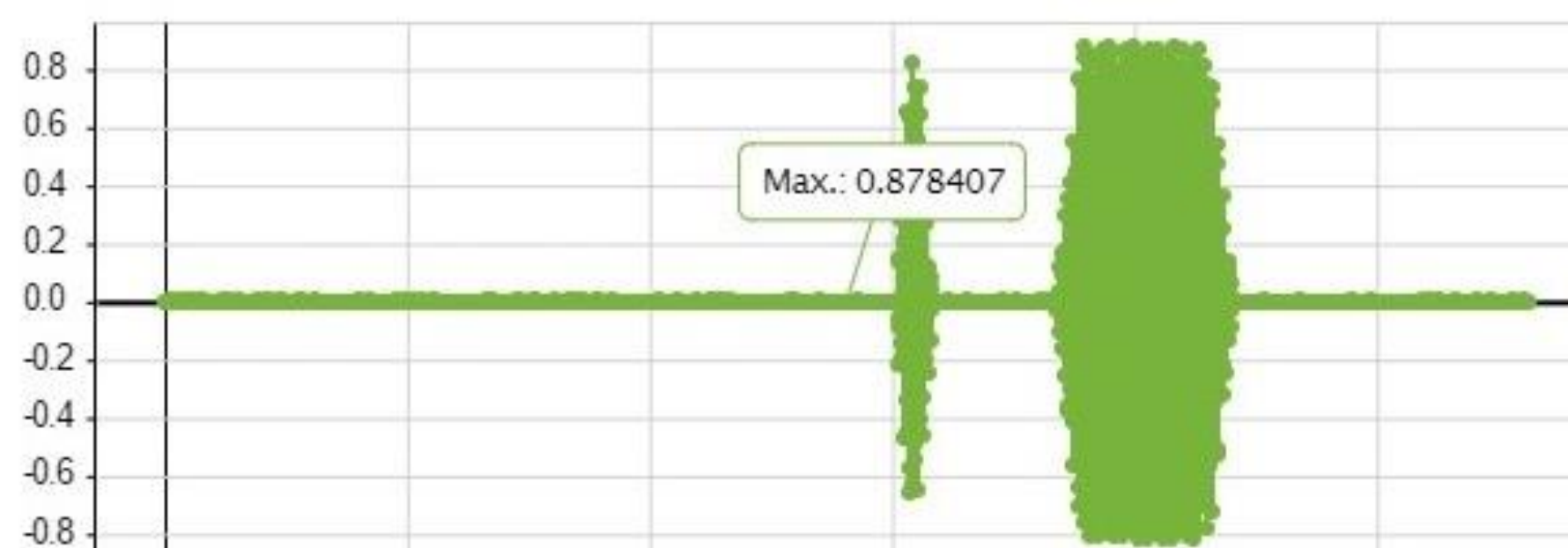


Figure 3. Acceleration (G's vs. Time) Recorded During Calibration of Shake Table (Simulated Hurricane Wind Loads - 1000:1 Scale)

References

- Cortes-Delgado, M. (2005). Development of the UPRM Earthquake Simulator Facility for Dynamic Model Analysis. M.S. Thesis, Department of Civil and Environmental Engineering, UPRM. June 2005.

Objectives:

The main objectives of this research work are the following:

- Construct a rigid chair with the purpose of experiencing the real dynamic forces applied to a structure.
- Test the rigid structure (chair) applying sinusoidal and random dynamic loads.
- Implement outreach module for the community of Puerto Rico.
- Integrate this module to an experimental course under development by Dr. Cortes-Delgado for undergraduate and graduate students.



Figure 2. Chair Prototypes (Design and Construction)

Outcomes:

The following outcomes were obtained:

- Shake table was tested simulating conditions similar to a real earthquake.
- Special belts and buckles properly restrained the subjects experiencing the dynamic loads.
- Basic understanding of dynamic loads and earthquakes was gained by the subjects in an experiential and creative manner.



Figure 4. Shake Table Calibration With Chairs and Weight Applied

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