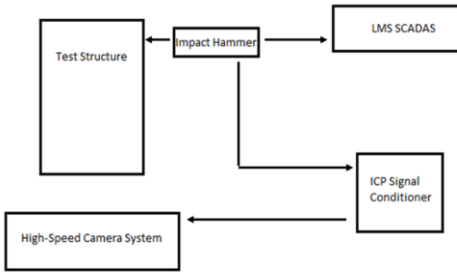
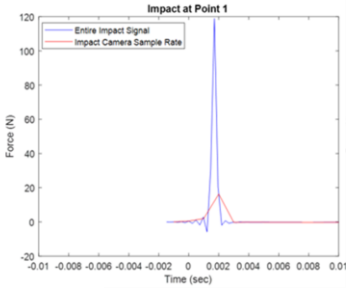
Structural Dynamics and Acoustic Systems Laboratory
University of Massachusetts Lowell
http://sdasl.uml.edu

Optically Measured Frequency Response Functions Referenced to Synchronized Input

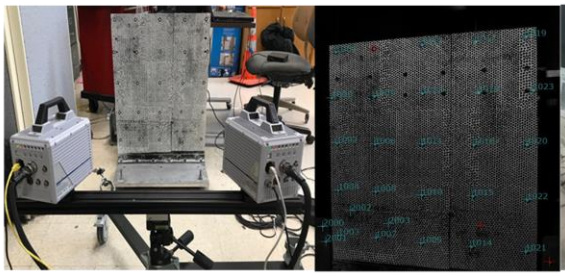
Test Design to Achieve Simultaneous Triggering



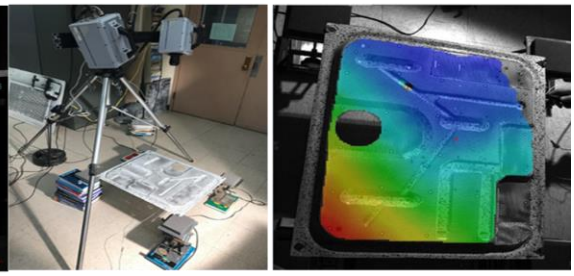
Synchronizing Force to Camera Sample Rate

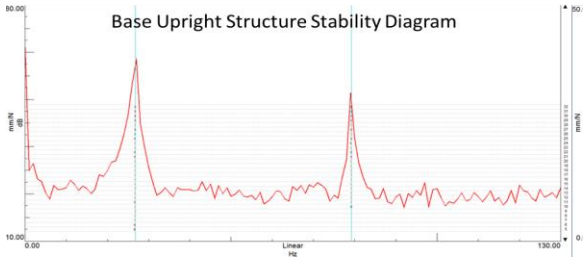


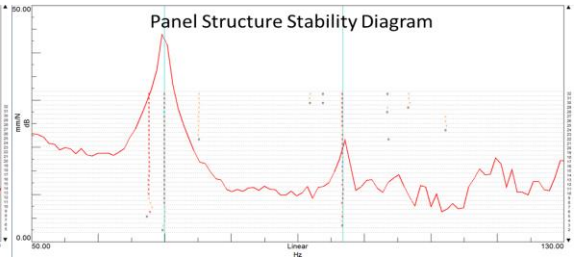
3DPT Measurement of Base Upright Structure



DIC Measurement of Panel Structure

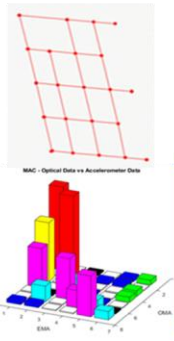






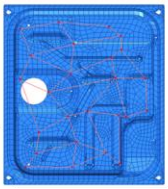
Base Upright Structure Correlation

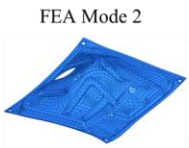
Accel Mode Number	Optical Mode Number	Accel Frequencies (Hz)	Optical Frequencies (Hz)	Frequency % Difference	MAC Value (%)
1	1	26.697	26.723	0.269	99.8
2	2	79.171	79.204	0.267	99.6



Panel Structure Correlation

Mode Number	FEA Frequencies (Hz)	Experimental Frequencies (Hz)	MAC Value (%)
2	63.155	69.997	94.1
3	97.126	96.771	90.4





A technique to synchronize the data acquisition for high-speed camera and LMS Supervisory Control and Data Acquisition System (SCADAS) is introduced. Traditionally, optical response data has not been normalized to the input into the system before extracting modal parameters. Only the operational response data is typically used, which makes it difficult to identify stable poles to curvefit and results in poorly correlated shapes. The synchronization between the high-speed camera system and the impact force measured by the SCADAS was used for validating the accuracy of the optical measurements in extracting frequency response functions (FRFs) that are properly referenced to the input force for experimental modal testing.

The technique has been studied using two test structures: a base-upright structure, 24 x 24 inches, 0.75-inch thick aluminum plate, rigidly bolted to the floor at four locations while the upright was 24 x 36 inches, and Whirlpool dryer cabinet base panel with many contours and features. Only two modes of each structure were of interest for this study. Correlations between the optical and accelerometer measurements and finite element models is shown using the Modal Assurance Criterion (MAC) and frequency difference. This technique proved to be useful to formulate optically measured FRFs properly referenced to the force input for an experimental modal test and compared well to the frequencies and mode shapes for the structures studied.

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