A COMPLETE DATA ANALYSIS SOFTWARE FOR PROCESSING AND VISUALIZING RESPONSE SIGNALS ACQUIRED DURING VIBRATION TESTS ON LAUNCH VEHICLE SUB ASSEMBLIES

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Agenda

- Introduction: System Details
- Why this Data analysis software?
- Objectives of the Designed software
- Overview of the automated tasks
- Software Flowchart
- Software Architecture
- Challenges in Development
- How MATLAB GUI is useful
- User Interface
- Conclusion
Introduction: System Details

- Why vibration test?
  - To ensure workmanship
  - To increase confidence level
  - To determine mechanical characteristics

- Vibration Test Setup
  - Electrodynamic Shakers in closed loop control
  - Piezoelectric accelerometers for response measurements
  - Vibration controllers to provide control signals
  - Power amplifier to drive electrodynamic shakers
Vibration Test set up

Data Acquisition System

PC for Data Analysis

Shaker

Signal Conditioner

Vibration Controller

Power Amplifier
Why this Data analysis software?

- For performing analysis on multiple time data information in quick and accurate manner.
- For avoiding confusions and errors arising due to human operations.
- For providing more user capabilities in order to carry out detailed analysis.
- For generating automated reports with minimal user intervention.
Objectives of the Designed software

- To simultaneously analyze and view 32 channel time data information.
- To extract frequency information from the acquired time domain data.
- To present the results in easily understandable form.
- To compare the processed results with previous similar data.
- To provide powerful features for the user for easier visualizations.
- To generate detailed as well as consolidated report as per user’s interest with minimal efforts.
Overview of the automated tasks

- Few user specified input and single click operation for processing and plotting multiple channel data.
- Allowing the excel file with stored parameter as input for reducing repeated typing works.
- User selectable options to modify plot properties for better viewing.
- Viewing of raw data with user input scale factors and user selectable XY range.
- User provided input coordinates to draw line.
- Option to hide and unhide one or multiple line in the plot window.
Software Flowchart

Start

User Input Data

Data Processing

Data Storage & Plotting

Report Generation

Stop

Time data

FFT points, Sampling Rate, Averages,

Channel Legend, Test Specimen Name, Scale Factor

Adjusting plot properties

Plot Format

Data Format
Software Architecture

- Data comparison
- User Input Test Point Generation
- Viewing raw data
- Data Retrieval
- Data Pre-Processing
- Data Storage with Header Information
- Graphical User Interface, MATLAB
- Plots & Report Generation
Challenges in Development

- To analyze huge amount of data with minimum user effort
- To develop a software to cater different test conditions, input parameters and test configurations
- To provide powerful data viewing features to the users.
- To develop a software which is specific to vibration testing applications.
- To minimize the repeated activities
- To automate the report generation process.
- To extract a specific time information for the huge available dataset.
- To provide all scope for further improvements.
How MATLAB GUI was useful

- MATLAB GUI had all the required features along with required technical functions.
- Data analysis and visualization functions were specific to the required application.
- ActiveX feature for reading and writing to Microsoft applications were extremely useful for report generation.
- MATLAB functions perform extensive data analysis activities and simplifies the programming task.
- MATLAB is a stand alone software for data management as well as data analysis /processing.
User Interface

Parameter Interface

All information about the test is typed on an excel file and provided as input here.

Information as available in excel file gets displayed here automatically.

Analysis settings and Time data file details are provided here.

Control to start analysis.

“START”
User Interface

Data Analysis Interface

Buttons to modify plot properties

Header for the selected test

Plot for user entered values

Legend for selected Channels

Over plotting of channels for comparisons

List of Analyzed Channels
User Interface

Time Data Analysis Interface

File Selection

Selecting user desired X and Y ranges to plot the data and step by step viewing using slider bar

Plot Window

Selecting Response channels for plotting
User Interface

Report Generation Interface

Options for preparing reports and presentation in MS-Word Format
User Interface

Interface for plotting user input data
User Interface

Typical Plot generated in MS-Word

ISDTF/SATG/STR
PSLV CXX DD
Random FAT Roll Axis
1P Near X1 deck

GRMS = 0.9

Freq (Hz)
PSD (g²/Hz)
Conclusion

- Report generation made easy
- Minimizing the repeated works
- Enhanced user capabilities for data visualization
- Data storage made easy
- Plotting user input coordinates for easier comparison
- Extraction of selected range and saving the data in a new file.
Thank You