Dataset: Ground Vibration Testing of a Flexible Wing: A Benchmark and Case Study

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Version 2
03/05/2023 Reference to Tables and typos.

Foreword

Thank you for downloading the dataset linked to the article Ground Vibration Testing of a Flexible Wing: A Benchmark and Case Study. Please when using the data included in this dataset always cite the following:

[1] G. Dessena, D.I. Ignatyev, J.F. Whidborne, A. Pontillo, and L. Zanotti Fragonara, 'Ground Vibration Testing of a Flexible Wing: A Benchmark and Case Study', Aerospace, vol. 9, no. 8. MDPI AG, p. 438, Aug. 10, 2022. doi: 10.3390/aerospace9080438.

[2] G. Dessena, 'Dataset: Ground Vibration Testing of a Flexible Wing: A Benchmark and Case Study'. Cranfield Online Research Data (CORD), 2022. doi: 10.17862/cranfield.rd.19077023.

Dataset

The dataset included in this accompanying data refers to the paper in [1]. The dataset presents the data collected in the testing campaign involving the eXperimental BearDS 2 (XB-2) flexible wing and its sub-assembly and parts. Table 1 recaps the specimens tested.

Table 1 Specimens tested

Specimen	*Description*
Twin spar	The twin spar is a spar that was manufactured for ground testing only and it is recognisable from the main, or actual, spar for its bridge plate.
Main spar	This is the spar used for the wind tunnel testing of XB-2.
Spar and tube	The spar and tube is the torque box of XB-2, which includes the main spar and the tube.
Full wing	This is the XB-2 wing, comprising spar, tube and skin.

All the characteristics, measures and properties of the specimens are available in [1]. Thorough information on the acquisition system is found in [1] (Section 2). However, for the reader's convenience, the position of the accelerometer is recalled in Figure 1 and Table 2.

Table 2 Accelerometer data and identification.

Number	*Channel ID#*	*Model*
1	*0*	PCB Piezotronics® model: 352C23
2	*1R*	PCB Piezotronics® model: 356A16

3	*1L*	Isotron® accelerometer model 7251A
4	*2R*	PCB Piezotronics® model: 356A16
5	*2L*	Isotron® accelerometer model 7251A
6	*3R*	PCB Piezotronics® model: 356A45
7	*3L*	Isotron® accelerometer model 7251A
8	*4R*	Brüel & Kjær® accelerometer type 4507-002
9	*4L*	Brüel & Kjær® accelerometer type 4507-002

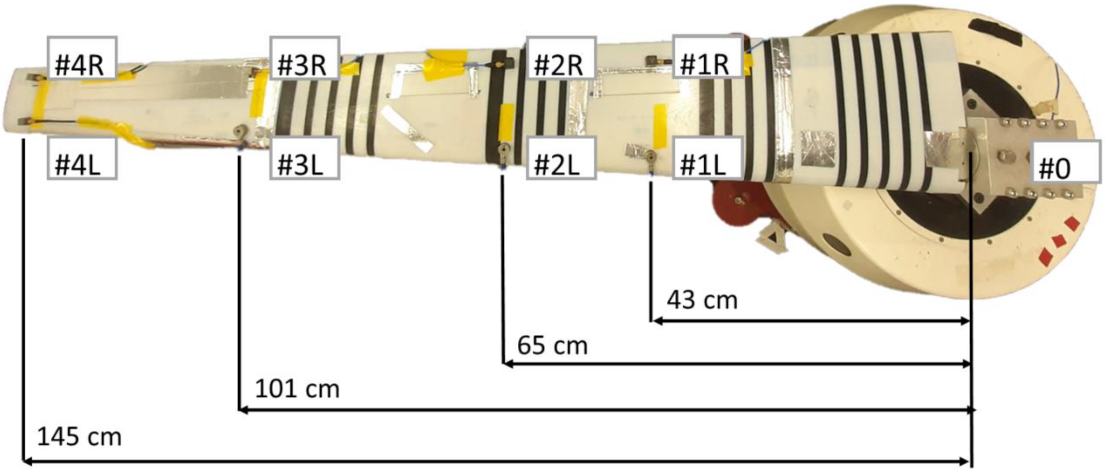

Figure 1 Accelerometers locations (retrieved from [1]).

In addition, Table 3 shows an interpretation matrix to link the matrix indexes to the specimen and input case.

Table 3 Interpreting matrix for the dataset

Input / *Specimen*	*Low*	*Medium*	*High*
Twin spar	1	2	3
Main spar	4	5	6
Spar and tube	7	8	9
Full wing	10	11	12

Information about the data amplitude and frequency is available in Section 2.3 of [1].

All the testing data is contained in a MATLAB .mat file named `data_xb2.mat`, which comprises the following data:

- FRF
    - The accelerance frequency response functions (FRFs) of the system for all specimens and input cases. The matrix is a *m* x *n* x *p* matrix, where *m* are the frequencies instants, *n* is the FRF channel (such that the FRF relative to accelerometer *number* - Table 2) and *p* is the test scenario, as described in Table 3;
- `fs`
    - sampling frequency of the data
- `input_rms`

    - RMS value in ms^{-2} of the input time histories for the three input scenarios
- `Modal`
    - matrix of the identified modal parameters as reported in [1]. It takes the form of a *m* x *n* x *p* matrix, where *m* = 1 represents the natural frequencies (in Hz), *m*=2 is the damping ratios, m=3:10 identifies the mode shape relative to the accelerometers number as per Table 1 (such that m = accelerometer number – Table 2) , n is the mode number and p is the test scenario, as described in Table 3
- `signal`
    - time history in ms^{-2} for the acceleration collected from the accelerometers in Table 1. It takes the form of a *m* x *n* x *p*, where *m* is the time instant, *n* is the channel relative to the accelerometer number as reported in Table 2 and p is the test scenario, as described in Table 3

For the users unable to obtain access to a licenced version of MATLAB, the author would like to remind you that it is possible to import .mat files into Python:

```
import scipy.io
data_xb2 = scipy.io.loadmat('data_xb2.mat')
```

For any questions, problems or any other enquiry relating to this document or dataset please email the author at Gabriele.Dessena@cranfield.ac.uk.

References

[1] G. Dessena, D.I. Ignatyev, J.F. Whidborne, A. Pontillo, and L. Zanotti Fragonara, 'Ground Vibration Testing of a Flexible Wing: A Benchmark and Case Study', Aerospace, vol. 9, no. 8. MDPI AG, p. 438, Aug. 10, 2022. doi: 10.3390/aerospace9080438.

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