Data Description for Mode II Delamination Tests Using End-Loaded Split Configuration

Wenjie Tu[*], John-Alan Pascoe, René Alderliesten

Delft University of Technology, Faculty of Aerospace Engineering, Department of Aerospace Structures and Materials

W.Tu@tudelft.nl

Introduction

The uploaded dataset collects test data related to quasi-static Mode II delamination tests using the End-Loaded Split (ELS) test setup. The dataset includes force-displacement data obtained from the MTS machine, damage events recorded by an Acoustic Emission (AE) system, and measurement of delamination growth. A set of images used for 3D digital image correlation (DIC) analysis, facilitating the extraction of surface strains, is provided for each of the specimen configurations tested. The energy dissipation extracted from the force-displacement responses is also provided for the calculation of the total energy dissipation (physical Energy Release Rate (ERR)).

This comprehensive dataset has been made accessible to the research community, serving as a resource for researchers to incorporate into their own research endeavours.

The material used in this research is M30SC-150-DT120-34F, unidirectional carbon fibre prepreg provided by Delta Tech Italy. The specimen configurations are shown in the following table:

Table 1 Details of the tested specimens.

Specimen label	Stacking sequence	Initial interface	Test procedure
UD(0//0)	$[0_8//0_8]$	0//0	Quasi-static
UD(0//90)	$[0_8//90/0_7]$	0//90	Quasi-static
UD(90//90)	$[0_7/90//90/0_7]$	90//90	Quasi-static
MD(0//0)	$[(0/90/45/-45)_s//(0/90/45/-45)_s]$	0//0	Quasi-static
MD(0//90)	$[(0/90/45/-45)_s//(90/0/45/-45)_s]$	0//90	Quasi-static
MD(90//90)	$[(90/0/45/-45)_s//(90/0/45/-45)_s]$	90//90	Quasi-static

// indicates the location where the initial delamination was inserted.

The specimen configuration and experimental setup is shown in Figure 1. The test setup was designed under the guidance of the test standard ISO-15114 (2014) [1].
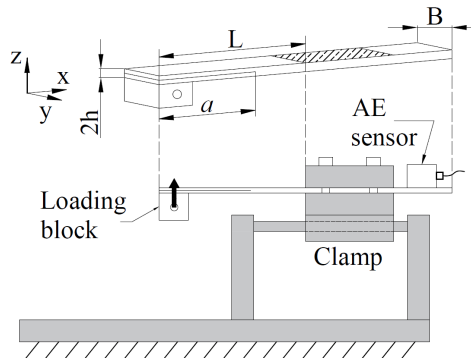

Figure 2 Specimen configuration and experimental setup

Dataset description

1. The AE dataset collects two types of data, transient signal waves of AE hits (tradb.) and the primary database (pridb.), which contains the main AE features of all AE hits. An open-source Python package is provided for loading the database: https://pyvallenae.readthedocs.io/en/stable. The Excel files under the 'AE' folder contains the results, including AE features and the corresponding force-displacement level, that have been extracted from the dataset.

2. The DIC images were provided with the calibration images (under the 'Cal' folder) and speckle images (under the 'FC' folder). The number (00xxx) in the name of the image files indicates the frame of DIC images. The number (0 or 1) at the end of the names indicates camera 1 or 2. The calculated strain components for several frames were stored in the Excel files with extensions of 'csv'. The overall information for each frame was stored in the Excel file without the extension of the frame number.

3. The force-displacement responses for all tested specimens were stored in the 'ForceDisplacement' folder as Excel files. For UD specimens, the calibration results used for calculating the ERR based on the corrected beam theory were also provided.

4. The Growth folder contains the measurements of delamination growth and calculated ERRs for different specimen configurations. The J-integral method proposed by Pérez-Galmés et al. [2] was used to calculate the ERR for generating the R-curve. The parameters used in the calculation were also provided in the Excel files.

5. The energy dissipation calculated based on the force-displacement responses was stored in the 'PhysicalERR' folder together with the increments of delamination growth.

Nomenclature

- AE   Acoustic Emission
- DIC   Digital Image Correlation
- ELS   End-Loaded Split
- ERR   Energy release rate
- MD   Multidirectional
- UD   Unidirectional

References

[1]   ISO, "INTERNATIONAL STANDARD - Determination of the mode II fracture resistance for unidirectionally reinforced materials using the calibrated end-loaded split test and an eefective crack length approach," 2014.

[2]   M. Pérez-Galmés, J. Renart, C. Sarrado, A. Rodríguez-Bellido, and J. Costa, "A data reduction method based on the J-integral to obtain the interlaminar fracture toughness in a mode II end-loaded split (ELS) test," *Compos. Part A Appl. Sci. Manuf.*, vol. 90, pp. 670–677, 2016, doi: 10.1016/j.compositesa.2016.08.020.