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Slow-velocity out-of-plane impact tests on double-wythe unreinforced brick masonry walls instrumented with optical measurements

Experimental data

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SUMMARY

This dataset includes the results of laboratory impact tests conducted on natural-scale double-wythe unreinforced brick masonry walls. The walls were spanning vertically between two reinforced concrete slabs and were subjected to slow-velocity drop-weight pendulum tests in which they were repeatedly hit until the opening of a breach in the center of the wall. The tests were instrumented with both hard-wired and optical measurements, the latter consisting of high-speed cameras and digital image correlation techniques. Investigated in these tests were the out-of-plane response of the walls and their capacity to resist the impacts. The axial load applied on the top of the walls was varied for two wall configurations and monitored throughout the tests to study the effect of arching on the failure mechanism produced and number of repeated hits needed to open the breach. Of interest was also the evidence of cracking, more specifically the way it initiated on the undamaged walls and next propagated upon consecutive hits. The data generated from the tests is made here available and documented to support further investigations on masonry structures subjected to extreme actions.

Use of the data

This data is open and freely available from the platform Zenodo (doi: 10.5281/zenodo.6838483) under the CC BY-SA 4.0 license. Test implementation and test results that are built upon this data are presented and discussed in the following research article:

Godio M, Flansbjer M., Williams Portal N. (2022) *Slow-velocity out-of-plane impact tests on double-wythe unreinforced brick masonry walls instrumented with optical measurements.*

To cite to this data in your work please refer to both the article and the dataset. A personal copy of the article can be requested by sending an email to the address: michele.godio@ri.se.

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Dataset content

The data is stored into 4 ZIP files:

`01_Data.zip` contains the measurements generated from the hard-wired and optical measurement systems.

`02_Damage_survey.zip` contains the drawings generated during the damage survey performed after each run.

`03_Photos.zip` contains the photos taken before and after each test.

`04_Videos.zip` contains the video recorded during each test.

`05_Matlab_files.zip` contains the MATLAB files to use in order to access the data. Notice that one can access the data by any other source code.

Data organization

`01_Data.zip`

The data contained in this file is organized into 3 datasets:

`2D_DIC_processed_data`

This dataset contains the field data generated from the 2D DIC method and processed by the software GOM Correlate. The data is stored into 12 CSV-files, each one corresponding to a different test and named after it: `W9-1.csv`, `W9-2.csv`, `W9-3.csv`, `W9-4.csv`, `W9-5.csv`, `W10-1.csv`, `W10-2.csv`, `W10-3.csv`, `W10-4.csv`, `W11-1.csv`, `W11-2.csv`, `W11-3.csv`. The data into each file is organized into 6 arrays:

Time [ms] is the time array.

Surface component 1.avg(epsX) [%] is the average deformation of the head of the drop weight.*

Surface component 1.avg(d)X [mm] is its average horizontal displacement.

Surface component 1.avg(d)Y [mm] is its average vertical displacement.

Surface component 1.avg(v)X [m/s] is its average horizontal velocity.

Surface component 1.avg(a)X [m/s²] is its average horizontal acceleration.

* Notice that this measure was not processed correctly and must therefore be disregarded.

`3D_DIC_processed_data`

This dataset contains the field data generated from the 3D DIC method and processed by the software GOM Correlate. The data is stored into 12 folders, each one corresponding to a different test and named after it: **`W9-1`**, **`W9-2`**, **`W9-3`**, **`W9-4`**, **`W9-5`**, **`W10-1`**, **`W10-2`**, **`W10-3`**, **`W10-4`**, **`W11-1`**, **`W11-2`**, **`W11-3`**. The data into each folder is organized into multiple CSV-files, each one corresponding to a time frame. All the files, expect for those belonging to the folder **`W9-1`**, are named as *testname_timeframe.csv*. Each file contains general information generated by the software related to the time frame at which it has been extracted plus the following 12 arrays:

id is number associated to the grid point.

x is the current horizontal position of the grid point.

y is the current vertical position of the grid point.

z is the current out-of-plane position of the grid point.

displacement_x is the horizontal displacement of the grid point.

displacement_y is the vertical displacement of the grid point.

displacement_z is the out-of-plane displacement of the grid point.

epsilon_x is the horizontal deformation evaluated at the grid point.

epsilon_y is the vertical deformation evaluated at the grid point.

major_strain is the major deformation evaluated at the grid point.

minor_strain is the minor deformation evaluated at the grid point.

mises_strain is the Von-Mises deformation evaluated at the grid point.

`Analogue_raw_data`

This dataset contains the raw data produced by the analogue measurements. The data is stored into 12 ASC-files, each one corresponding to a different test and named after it: `W9-1.asc`, `W9-2.asc`, `W9-3.asc`, `W9-4.asc`, `W9-5.asc`, `W10-1.asc`, `W10-2.asc`, `W10-3.asc`, `W10-4.asc`, `W11-1.asc`, `W11-2.asc`, `W11-3.asc`. The data into each file is organized into 10 arrays:

Time 1 - fast sample rate [s] is the time array.

1H [µm/m] is the strain measured by the gauge 1 placed on the steel rod at the right-hand side of the wall.

2H [µm/m] is the strain measured by the gauge 2 placed on the steel rod at the right-hand side of the wall.

1V [µm/m] is the strain measured by the gauge 1 placed on the steel rod at the left-hand side of the wall.

2V [µm/m] is the strain measured by the gauge 2 placed on the steel rod at the left-hand side of the wall.

403468 Kraftgivare 200kN [kN] is the force measured by the sensor placed at the top of the steel rod at the right-hand side of the wall.

403471 Kraftgivare 200 kN [kN] is the force measured by the sensor placed at the top of the steel rod at the left-hand side of the wall.

acc1 [g] is the acceleration measured by the accelerometer placed on the right-hand side of the drop weight.

acc2 [g] is the acceleration measured by the accelerometer placed on the left-hand side of the drop weight.

Coax +- 10 V [V] is the binary signal given by the manual trigger.

`02_Damage_survey.zip`

The data is organized into 3 folders, each one corresponding to a test unit: **`W9`**, **`W10`**, **`W11`**. Each of these folders contains, in turn, 2 subfolders, **`Back_and_right_side`** and **`Front_and_left_side`**:

- **W9**
  - **Back_and_right_side**
  - **Front_and_left_side**
- **W10**
  - **Back_and_right_side**
  - **Front_and_left_side**
- **W11**
  - **Back_and_right_side**
  - **Front_and_left_side**

Each subfolder contains the drawings of the damage survey performed after each test.

The drawings are named after the test name and stored in PDF and PNG formats.

03_Photos.zip

The data is organized into 5 different folders:

Damage_after_tests_all_walls

The folder contains photos of the three test units altogether after being tested.

Instrumentation

The folder contains close-ups of the instrumentation used in the tests.

Damage_survey_W9

The folder is organized into 6 subfolders:

- **Before_tests_W9**
- **Post_test_W9-1**

- **Post_test_W9-2**
- **Post_test_W9-3**
- **Post_test_W9-4**
- **Post_test_W9-5**

Each subfolder contains photos taken at different instances of the tests performed on the wall W9, namely before the wall was tested and after each test.

Damage_survey_W10

The folder is organized into 5 subfolders:

- **Before_tests_W10**
- **Post_test_W10-1**
- **Post_test_W10-2**
- **Post_test_W10-3**
- **Post_test_W10-4**

Each subfolder contains photos taken at different instances of the tests performed on the wall W10, namely before the wall was tested and after each test.

Damage_survey_W11

The folder is organized into 4 subfolders:

- **Before_tests_W11**
- **Post_test_W11-1**
- **Post_test_W11-2**
- **Post_test_W11-3**

Each subfolder contains photos taken at different instances of the tests performed on the wall W11, namely before the wall was tested and after each test.

The photos are stored in the JPG format.

`04_Videos.zip`

Each file contained in this dataset corresponds to a specific test recorded and is named accordingly. The videos are stored in the MP4 format.

`05_Matlab_files.zip`

This folder contains the main file `MAIN.m`, allowing to run the script for data extraction and data access, and two folders:

`Matlab_functions`

This folder contains the functions that are called by Matlab while executing the script. Each function is stored into a separate M-file.

`Output_mat_files`

This is an empty folder where the MAT-files generated by the script will be automatically stored. Once stored, these files will be accessed by the user without extracting the data once again.