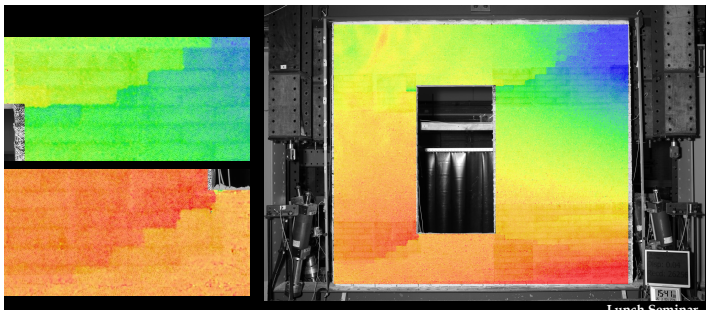

Lunch Seminar

DIC for monitoring of crack initiation and progression in masonry experiments

Presenter: Paul Korswagen

10 May 2019

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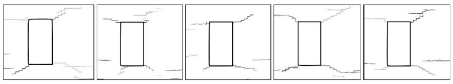
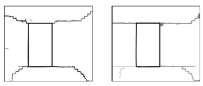
Focus of Light Damage Experiments in Masonry



- Monitor the initiation of cracks below 0.05 mm (50µm),
- Observe the progression of cracks between cycles of equal amplitude,
- Characterise the propagation of cracks,
- Objectively quantify damage based on cracks,
- Produce easy-to-evaluate and consistent graphs of the deformation of specimens.



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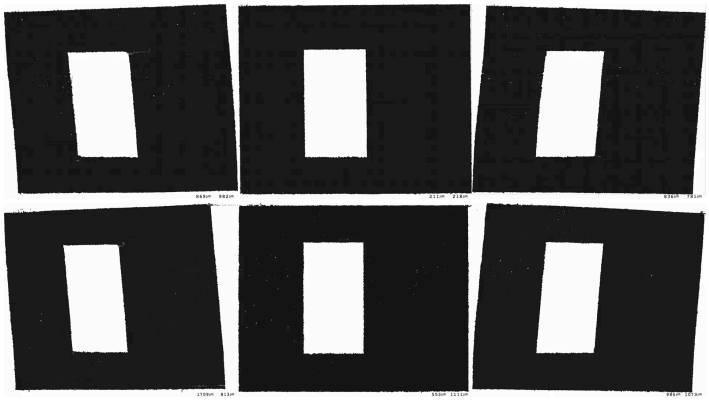

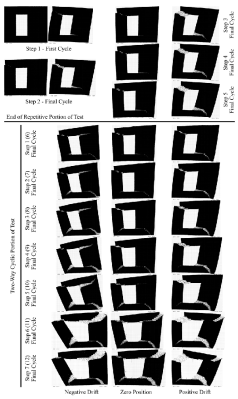

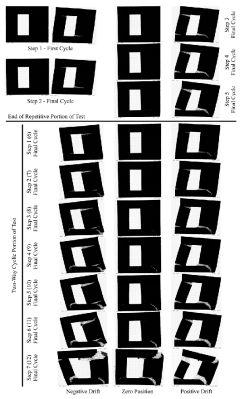

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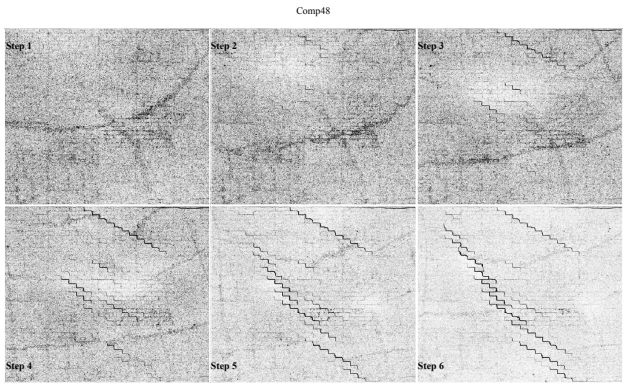

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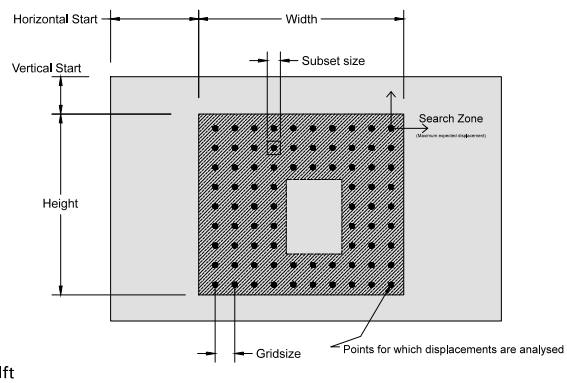

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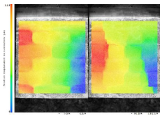
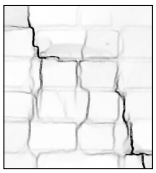
Requirements for DIC for Light Damage

- Achieve highest possible resolution:
  - Small subsets → Optimised pattern, limited search-zone algorithm;
- Look at discontinuities in displacements, not smooth strains:
  - Independency between subsets,
  - Insight into overlap of grid point information;
- Crack detection and characterisation
- Full **Automation**:
  - Load images → Results + Graphs





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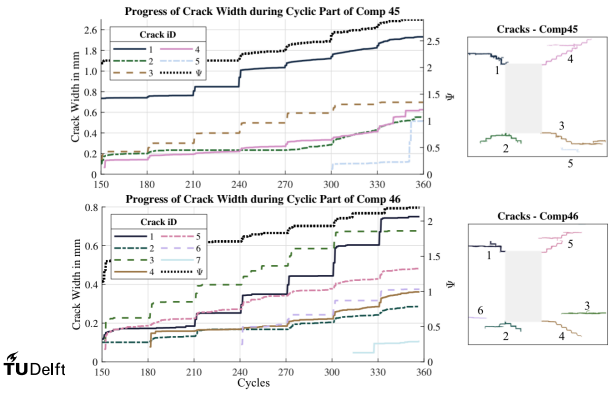

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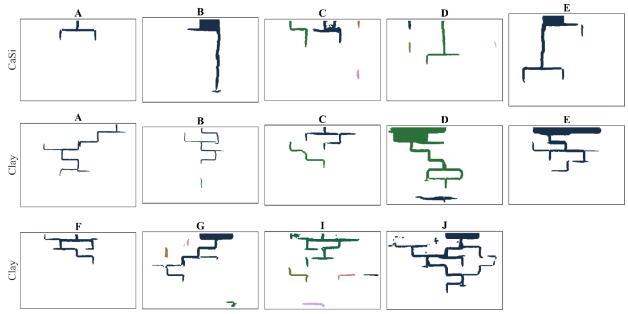
Modified four-point bending tests



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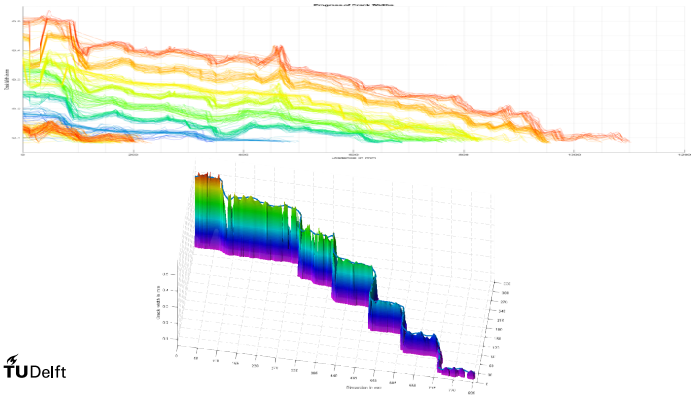

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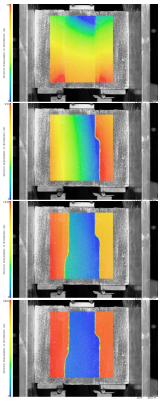
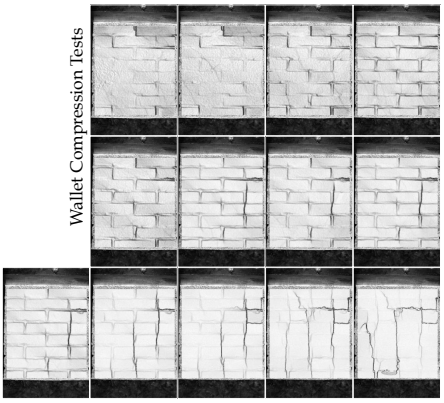


Shear Triplet Tests



Wallet Compression Tests

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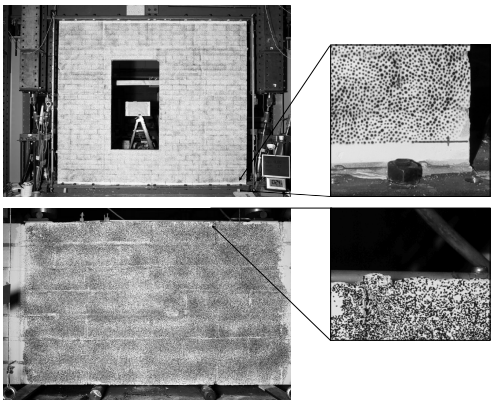

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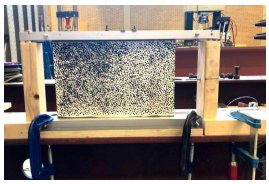
Pattern and Hardware

- Computer-optimised pattern painted on the white masonry surface with laser-cut moulds,
- Smaller pattern consisted of graded sand sprayed on wet paint.

- DSLR with 51 MPx, sharp and distortion-free* lens. Up to 5 fps,
- Flash for even and consistent lightening, and zero image blur,
- Computer-triggered setup.



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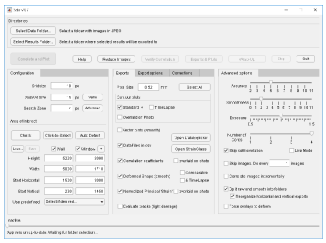
Software - Sdic

- Pearson-correlation search of subset positions,
- Self-coded in Matlab language,
  - Tailored for specific needs, adaptable, automatic, GUI or programatic,
  - Crack characterisation algorithms,
- Stand-alone app (does not require Matlab by the user), deployable on all platforms



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Limitations

- Only 2D surfaces and 2D displacements,
  - No 3D or out-of-plane;
- Small displacements and no significant rotations;
- Not focused on strains but on displacements and cracks;
- Solving in parallel multi-threaded Matlab code is not as fast as parallel C,
  - Speed is compensated by automation and lack of user interaction requirements.
- Slow live-view

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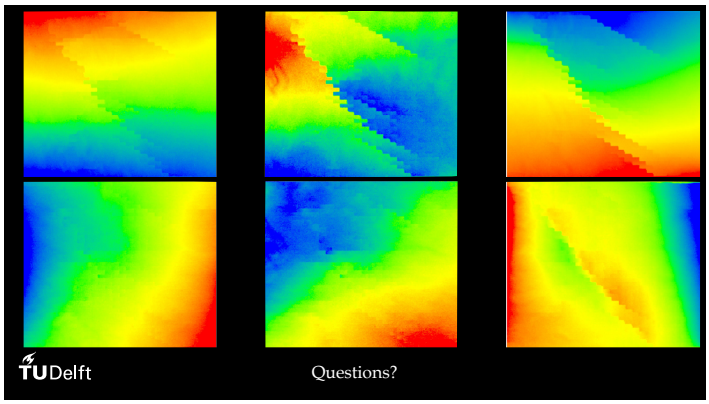

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Questions?