**ETH-ScopeM\_Concrete**

**Contacts**

Requesters

Susanna Governo (susanna.governo@ifb.baug.ethz.ch)

Emanuele Rossi (emanuele.rossi@ifb.baug.ethz.ch)

Ueli Angst (ueli.angst@ifb.baug.ethz.ch)

ScopeM

Benoit Dehapiot (benoit.dehapiot@scopem.ethz.ch)

**Description**

CT scan images of concrete cylinders

**Tasks**

**1. 3D stacks registration**

One of the main task for this project is to spatially register (align) 3D stacks of the same cylinder acquired at different time-points. However, due to inconsistent imaging conditions, basic 2D registration algorithms will not be sufficient to properly align the 3D volumes. Indeed, the stacks are off-centered (zyx) and slightly misaligned compared to the observation axis, as well as presenting some scaling issues. This is revealed by the fact that the rod axis is not perfectly parallel to the z-axis, and cylinder diameters vary over time (*Figure 1*).

**A collage of images of a light

Description automatically generated**

Figure 1 : 3D stacks misalignement

Consequently, the registration must be carried out considering cylinders as 3D objects and correct translation, rotation and scaling issues. These steps can be performed all at once by first detecting matching landmarks in the different 3D stacks and using an affine transform to align these points.

1.1 Detecting matching landmarks

Air voids, dispersed in the concrete cylinders, constitute good features to find matching landmarks over the different time-points. This requires to first segment the voids and later match them to each other using criteria such as volume, shape, distance from each other and the external surface.

The segmentation process require to first normalize

**2. Air voids and filling liquid segmentation**

Once the registration perform

A screenshot of a computer screen

Description automatically generated

Figure 2 : Air voids segmentation

**3. Analysis**