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Studienarbeit

Digital Volume Correlation for CT data

Digital Image Correlation (DIC) compares two images to calculate displacements, and subsequently the surface strains on a structure. This method is well established. In the last 15 years, however, Digital Volume Correlation, where 3D image data are used instead, have gained significant attention (Figure 1). At the Institute of Applied Mechanics, we have a Xray computer tomograph that we use to determine the internal structure of different materials, for example concrete. We use this geometric information to simulate multiple physical processes in the material, including the mechanical response (stress-strain). An important validation of these models could come from accurate identifications of the 3D strain fields.

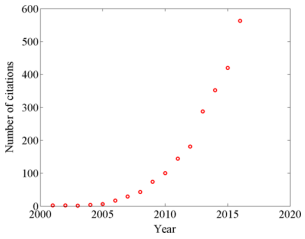

Fig. 1) Articles on "Digital Volume Correlation"[1]

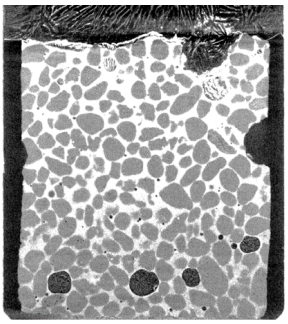

Fig. 2) CT-scan of water freezing inside concrete

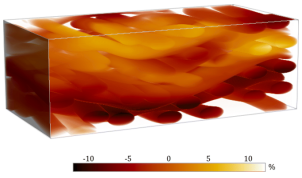

Fig. 3) DVC-calculated shear strains in a composite [1]

In this project, we want to investigate the properties of existing (open source) DVC software, predominantly SPAM [2]. Specifically, we like to compare local and global DVC strategies, assess the influence of the DVC parameters on speed and accuracy, and determine the required image quality.

Prerequisites: basic knowledge of python

Tasks

- Familiarize yourself with CT data and the SPAM software
- Use SPAM to estimate displacement fields and visualize in Paraview
- Check crack surface estimation from the DVC residual
- Assess the influence of the signal-to-noise ratio in the CT data

References

[1] Buljac, A., Jailin, C., Mendoza, A. et al. Digital Volume Correlation: Review of Progress and Challenges. Exp Mech 58, 661–708 (2018).
[2] SPAM: Software for Practical Analysis of Materials, https://www.spam-project.dev/