

Doctoral candidate 4: Progressive visual data analysis and visual steering in dynamic X-ray imaging processes

Host Institution	Fraunhofer IIS
PhD enrolment	University of Passau, Germany
Primary Supervisor	Prof. Dr. Christoph Heinzl
Subject area	Visualization, Visual Analytics, Visual Computing

About this doctoral project and your tasks

You will design, implement, and evaluate concepts for progressive visual data analysis and visual steering of the X-ray CT data acquisition of an ongoing (typically interrupted) in situ testing experiment, applied to a sample of interest, such as shape memory polymers or alloys. Together with DCs focusing on the experimental parts of dynamic X-ray imaging of emerging materials, real world experimental data will be generated. For the initial stage representative virtual XCT data will be used as generated by X-ray CT simulation. DC4 will focus on the design of visual metaphors for the analysis of rich XCT data, comparative and ensemble visualisation. Aside from primary volumetric data, rich XCT data will also include secondary derived data from features of interest (e.g., characteristics of constituents, pores, defects, inclusions). The developed techniques will facilitate the investigation of multiple rich XCT datasets from two or more subsequent steps of the in situ testing experiment. The developed comparative visualisation techniques need to reveal similarities and differences in rich XCT data of adjacent steps. Interactive ensemble visualisation techniques will facilitate a full overview of the ensemble data available in the (ongoing) in situ experiment as well as a multilevel exploration drill-down from the overview to the individual steps of the experiment. Suitable metrics for rich XCT data comparison will be evaluated in terms of changing spatial structures and secondary attributes, considering the shape models implemented by DC3 to facilitate the derivation of parameters controlling the experiment for visual steering (e.g., in terms of the speed/step width of the running experiment).

Your tasks will include :

- Two publications describing the generated concepts and design studies regarding visual analysis and visual steering of XCT data in in-situ testing experiments; a software tool demonstrating the implemented techniques in terms of visual steering
- an evaluation report of the generated methods on simulated and/or real world XCT data

Foreseen secondments

For this project, we foresee secondments to:

- **Prof. Guillermo Requena** (2 month) at Deutsches Zentrum für Luft-und Raumfahrt EV (Germany)
- **Dr. Daniel Vavrik** (4 months) at Czech Academy of Science (The Czech Republic)