Doctoral candidate 3: Mathematical modelling of shapes and deformations

Host Institution	University of Passau, Germany
PhD enrolment	University of Passau, Germany
Primary Supervisor	Prof. Dr. Tomas Sauer
Subject area	Mathematical modelling, shapes, deformations

About this doctoral project and your tasks

You will develop efficient algorithms with a strong mathematical focus to transfer this shape information into a representation that can be integrated into reconstruction algorithms or serve as a basis for visual steering. This information will be used to enhance the quality and efficiency of reconstruction methods but also allows for a decomposition of the difference between measurement and prescribed shape into deformation vectors applied to the surface. Next, you will identify proper formats for efficient interaction with reconstruction algorithms (e.g., discrete voxel representations), and their manipulation (e.g., by three-dimensional subdivision algorithms). Finally, the conversion between these formats and standard shape descriptors will be investigated to eventually improve the performance of reconstruction algorithms and to provide base data for visual steering (e.g., by means of analysing and visualising deformation vector fields in deforming shape memory polymers or alloys).

Your tasks will include :

- Methods identified that include 3D CAD models in the reconstruction using discrete approximations techniques based on adaptive splines and multilevel refinement of surfaces and volumes; testing and mathematical verification.
- Model extended with deformations and methods to quantify deviations from prescribed shapes
- Surface models integrated as boundary constraints into reconstruction algorithms Visualisation

Foreseen secondments

For this project, we foresee secondments to:

- **Prof. Dr. Jan Sijbers** (3 months) at University of Antwerp (Belgium)
- **Dr. Lucia Mancini** (3 months) at Slovenian National Building and Civil Engineering Institute (Slovenia)

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