Design Decision Support for Additive Manufacturing in Digital Design

Additive Manufacturing in Construction (AMC) envisions an alternative of predominately manual construction and machine-assisted subtractive fabrication. Our project is funded by DFG (German Research Foundation) and aims to establish an advanced design decision support system to integrate digital design and AMC, considering multiple design criteria during early design stages. The following topics are preliminary available for IDP but could be adjusted for master thesis after discussion. Background knowledge, insights and initial implementation when applicable will be provided throughout the supervision period.

- Recognition of manufacturing features in BIM-based design
  AM technology extends geometric freedom to the architectural design, but still demands early recognition of manufacturing features (e.g., overhang) before fabrication. However, localized functionality of feature recognition is still missing on modern BIM (Building Information Modelling) authoring systems. Thus, the goal of this topic is to develop/extend an add-on for detection of AM-specific manufacturing features on a BIM authoring system (Revit). Basic skills with object-oriented programming languages are required. Prior knowledge of AM and 3D model slicing would be an advantage but is not mandatory.

- A question and answering system for AMC knowledge base
  One barrier to AMC adoption is limited support for design decisions in early design stages. The state-of-the-art technology of the Semantic Web provides open access to multidisciplinary knowledge, but there are still barriers for architects to directly access the ontological knowledge base. The goal is to develop a question & answering (QA) system that informs architects about AMC related inquiries. This QA system will interface with a pre-defined, AMC-specific knowledge graph. Basic programming skills with Python are required, and knowledge/interest in natural language processing (NLP) would be an advantage.

Project information:
https://www.arc.ed.tum.de/ai/forschung/building-information-modeling/tranregio-amc/c04/
https://www.tu-braunschweig.de/trr277

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