University of Stuttgart

Institute for Control Engineering of Machine Tools and Manufacturing Units

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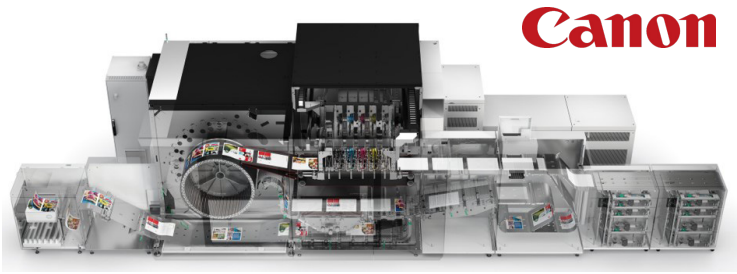
Master Thesis
Bachelor Thesis

to assign

A Composition Framework for Component-based System Modeling

Background

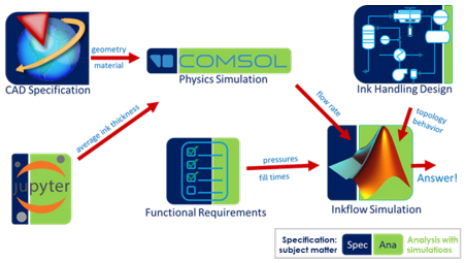
Canon Production Printing (CPP) develops high-quality and high-speed printing systems in multiple product lines for the commercial printing market worldwide. For an increased R&D efficiency when designing new products, they employ model-driven (system) engineering. To this end, CPP employs various system models, e.g., geometrical, behavioral, chemical & physical, and AI models (e.g., ML/DL). These models can be connected at system-level by using a component-based modeling technique like SysML parts, or the structure-part of ROOM. By connecting and composing the components, new products can be developed.



An example: Canon VarioPrint iX printer

Problem description

Since the component models encode a multi-disciplinary agreement of a system's structure, there are several aspects representing various domains to be captured by components, such as the mechanical structure designed in an NX CAD model, the physical behaviors simulated in COMSOL, and flow dynamics simulated in Matlab. However, it remains unclear, what the semantic implications and restrictions are of composing such models that are across various domains. Therefore, this thesis will investigate selected engineering models employed by Canon Production Printing, what their properties relevant to composition are, and how this composition can be checked and realized.



An example: multi-disciplinary specifications and models for ink analysis

Tasks

- Analysis of multi-disciplinary engineering models employed by Canon Production Printing
- Development of concepts & requirements for the composition of relevant model properties
- Realization and integration of the concepts into the existing prototype of Canon Production Printing
- Evaluation with real-world use case provided by Canon

Requirements

- Interested in model-based engineering
- Interested in domain-specific languages
- Object-oriented thinking and development
- First experience with Java or similar object-oriented programming languages
- Independent worker & proactive attitude
- English

Knowledge gain

- Component based modeling
- Domain specific language engineering
- Real world model-based (system) engineering
- Industrial use cases and cooperation
- Autonomous scientific working and publication

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