

Master

Modellbasierte Konsistenzanalyse automatisierter Materialflusssysteme

Model-based consistency analysis of automated material flow systems

Motivation — English

Cyber-physical production systems are production systems that are accompanied by digital assets that help to control and monitor them. Automated material flow systems (aMFS) are parts of cyber-physical production systems that handle the flow of material from workstation to workstation and how they are processed. Analyzing aMFS before building is important, because changing a prescriptive model is considerably cheaper than changing an aMFS that is already built physically. Specifications of aMFS based on model-based approaches from the software-engineering domain are promising for specifying and analyzing these systems for inconsistencies, that can lead to slower production rates than necessary or even to functional incorrectness.

In our current project “Explainable AI for Automated Production Systems (XAPS)”, funded by the BMBF, we develop model-based abstractions for explaining the results of AI for finding issues in these systems. In preliminary work we developed a language “Flowscale” for specifying aMFS for a synthetic example use case (a sweets-on-demand system) and built the system in hardware and software. From the language, code is generated on ESP8266 controllers that drive the system. The language is neither built for, nor has it been analyzed for consistency management. The goal of this thesis is to improve the development of automated material flow systems with an approach for analyzing model-based specification of aMFS for inconsistencies.

As a guidance, we provide the following research questions:

- RQ 1: How must the Flowscale language be adapted to model the given example system?
- RQ 2: Which inconsistencies can occur in models of the newly developed language?
- RQ 3: What are possible consequences of these inconsistencies?
- RQ 4: How can these inconsistencies be identified, located, and mitigated?

In this thesis you will:

1. Investigate the data and machine descriptions of a demonstrator system specification coming from the project XAPS.
2. Investigate the Flowscale language and adapt it to describe the given demonstrator.
3. Systematically search for and describe possible inconsistencies in these models and their consequences.
4. Develop an approach and a prototype tool to identify, locate and mitigate these inconsistencies
5. Apply your approach to the demonstrator.

Knowledge required to carry out the work: Java

Helpful knowledge: XText, model-based software development with Ecore

Organisatorisches

Kontakt:

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Literatur

- [1] Pedram Golkar-Hamzey-Yazd, Christian John, Sebastian Pobel and Maximilian Staubach, *Bericht der Projektgruppe “Flowscale”*, 2018, Universität Duisburg-Essen (auf Anfrage bei konersmann@uni-koblenz.de)
- [2] B. Vogel-Heuser, M. Konersmann, T. Aicher, J. Fischer, F. Ocker and M. Goedicke, *Supporting evolution of automated material flow systems as part of CPPS by using coupled meta models*, 2018 IEEE Industrial Cyber-Physical Systems (ICPS), St. Petersburg, 2018, pp. 316-323, doi: 10.1109/ICPHYS.2018.8387678.