

Modeling and analysis of the workflow around wide format roll-to-roll Océ printers

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1 Subject

In this assignment we look at modeling and analysis of the workflow around wide format roll-to-roll printers. Such a printer prints large images (posters, banners, etc) on different media. The operators have to change rolls (when a roll is empty or another media type is needed), to fill ink (ink handling can be done during print), and remove waste. Furthermore, the operator may have to perform preprocessing and offline postprocessing (for example laminating) on specific jobs. To some extent, the operator can reorder print jobs.



To investigate the workflow in terms of timing and productivity, we propose to use a mathematical model that allows automated analysis and optimization of the workflow. Recently, we have developed a formal modeling approach [1] to model manufacturing systems. In this assignment, you will investigate the application of this approach to create a behavioral model of the workflow around wide format roll-to-roll printers. This model needs to capture the timing aspects, and in which order, and when, the operator can execute certain tasks. This model can then be used to optimize the workflow of the operator. The model should also capture the size of the rolls and amount of paper used in each job, in order to minimize the amount of paper wasted. If certain aspects of the workflow cannot be captured using the current modeling approach of [1], or cannot be analyzed with existing analysis methods, the approach needs to be extended. It is expected that the novel modeling approach enables more compact, easier to understand models and faster analysis compared to state of the art approaches (using e.g. Matlab/SimEvents).

2 About Océ

Océ Technologies, a Canon Group company, is an international leader in digital document management and printing for professionals. Many Fortune 500 companies and leading commercial printers use Océ solutions for wide format printing, high-speed production printing and document-related business services. Océ employs 4,000 specialists at innovation and technology centres in Europe, North America and Asia. Through its own Research & Development (R&D), Océ develops core technologies and the majority of its own product concepts.

3 Assignment

The assignment of this Master Project is to model and optimize the workflow around wide format roll-to-roll printers using the formal modeling approach in [1]. The approach needs to be extended if certain aspects of the workflow cannot be captured.

The following steps are suggested:

1. Get familiar with the problem domain, and the formal modeling approach.
2. Investigate the capabilities and limitations of existing approaches to model the workflow.
3. Develop models of the workflow that capture the relevant behavior and productivity aspects.
4. Use the models to analyze the trade offs in productivity and cost (paper usage and waste).
5. Evaluate the suitability of the modeling approach for this problem domain.
6. Extend or adapt the modeling approach and the supporting analysis methods if needed.
7. Optionally, develop domain-specific tool support for domain experts in using the formal modeling approach.
8. Analyze the performance of the workflow and possibly optimize it using the models.
9. Report your approach and findings in a written report and a public presentation.

4 I want to know more!

The project is hosted by the Electronic Systems (ES) group, Electrical Engineering department.

If you are interested in this topic (or something similar) for a project or internship, please contact Bram van der Sanden (b.v.d.sanden@tue.nl) for more information.

References

- [1] Bram van der Sanden, Joao Bastos, Jeroen Voeten, Marc Geilen, Michel A. Reniers, Twan Basten, Johan Jacobs, and Ramon R. H. Schiffelers. Compositional specification of functionality and timing of manufacturing systems. In *Forum on Specification and Design Languages, FDL 2016, Bremen, Germany, September 14 - 16, 2016*, 2016. in submission.