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Aachen, 12. December 2022

V. Name - Tel. 0241-80 xxxxx

Master Thesis

for Ms./Mrs. Cand.-Ing. Erika Mustermann
Matriculation number: 081511

Topic: Entwicklung eines Werkzeugs zur Abbildung des Kommunikationsverhaltens und zur Wiederherstellung diskreter Systemzustände der Leitsoftware cosmos4.

The start of production for series production represents a major uncertainty and cost factor for both manufacturers and users of automated production systems. In particular, the poor planning of the production start-up requires new approaches that support the early safeguarding of the functionality and performance of automated production systems. Within the BMBF joint project Ramp-Up/2, the step from two-dimensional alphanumeric planning to an integral 3D-based digital verification of plant development and commissioning is aimed at. For this purpose, a kinematic 3D model of the production plant and all control components (NC/PLC) are simulated by virtual NC/PLC software modules and the mechanical behaviour of a machine is depicted by the Siemens Machine Simulator (MS). Based on this virtual production system, the aim of the plant development is to enable a preliminary verification of the production control software. In doing so, technical errors as well as operating and software errors are to be simulated and the reaction of the control software is to be analysed by means of diagnostic tools.

Within the scope of the work, concepts and tools are to be developed which enable the testing of the functionality of a production control software. In particular, the following questions are to be dealt with: which test cases can occur, how errors/tests can be reproduced, which data are necessary for the clear diagnosis of an error and to what extent tools can be used for error correction. Based on these considerations, a concept for information visualization is to be developed and realized exemplarily. The information content as well as the temporal sequence of the information flow within the production control software should be mapped and the possibility should be provided to reset the system into a freely defined state (time). The developed concepts are to be realized exemplarily on the basis of the control software cosmos4. The functionality and performance of the developed tools will be verified using an example scenario in the Integrated Manufacturing and Assembly

System (IFMS) of the WZL.

In detail, the following subtasks have to be solved:

- Introduction with the leading software cosmos4
- Development of a comprehensive concept for error diagnosis and correction
- Exemplary realization of a scalable information visualization and recovery
- Documentation of the work

Prof. Dr.-Ing. Robert Schmitt

I Contents

II Acronyms

Symbol	Unit	Description
a_e	mm	Width
a_p	mm	Cutting depth
t		Number of teeth [Note: Sorting is alphabetical]
α		angle

Abbreviation	Description
DP	Polycrystalline diamond

III List of Figures

IV List of Tables

1 Introduction

The following chapter is a description for using Latex. The most basic steps will be explained including citation, adding figures, making tables, ... and so on. If you have already used Latex before or are familiar with the process, this chapter might not be interesting for you. But if you are new to the concept or need a refresher, the following might be useful to you.

Not everything might be apparent if you are reading this text as a PDF-file. For further understanding, read the actual latex-file (go to 01-chapters/ch1-intro.tex).

1.1 Getting started with Latex

If you haven't worked with Latex yet, you first have to install a few things. Go to the README.md file and follow the instructions.

1.2 Add a new chapter

To add a new chapter, right-click on 01-chapters and add a new document. In order for it to be displayed in your PDF-file, it first has to be included. Go to main.tex and include it, as shown.

1.3 Including figures

The command to include a graphic is "\includegraphics". To add a description use the following command "\caption{your Text}". However this command can only be used in a specific surrounding (marked by "\begin{figure}" and "\end{figure}".

The surrounding has also other functions, which you can use; for futher information look up the following website: `https://de.overleaf.com/learn/latex/Inserting_Images`

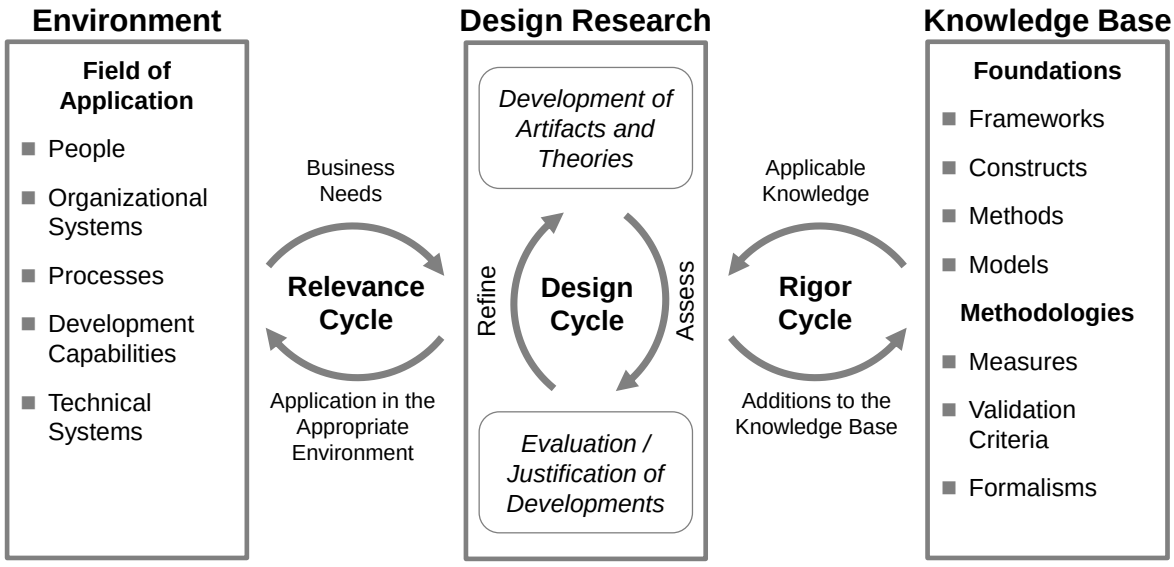

Figure 1.1: TMP: Design science research framework original image [based on HEVN04, p. 80].

1.4 Including tables

The compilation of a table can be difficult, especially if everything needs to be consistent. In order to simplify this task, try using the following website: `https://www.tablesgenerator.com/` It provides a simple user interface, which generates the table for you.

The "label"-command is for referencing the table or graphic in your text: Table 1.1.

Table 1.1: Comparison of different desserts.

hier soll was stehen	gut	neutral	schlecht	k.A.
Käsekuchen				
Schokotorte				
Brombeereis				

1.5 Citation

In order to cite a reference, it first has to be included to the Bib. To do so, follow the instructions of the following link: `https://www.youtube.com/watch?v=kbvf01ExKVU`

[based on HEVN04, p. 80]

[HEVN04, p. 80]

[LAMP86]

1.6 Acronyms

For adding something to the Acronyms, go to "en" or "de" (depending on you using german or english) and select "frontmatter.tex". In this document you will find the table of Acronyms.

2 Theoretical Background

Topics to consider when starting the Sensor Health Monitoring process are mainly that of providing a structured overview of the Sensor Metadata which in itself consists of many layers as a dynamically generated set of metadata is desired. This should be able to accomodate changing Data Acquisitioning (DAQ) System configuration changes. Consideration is given to the SOIL data model and its' ability to accomodate the many demands that are expected of sensor data management. [**SOIL model**] The second major part to consider is that of physical crossrelations and d̈eep checksẅhich are a experimental mode of checking for inconsistencies among the data. Major research and implementation work shall go into developing a dynamic model that is generated from the data and then checks back upon the data for possible discrepancies. This approach is chosen as it is estimated to be the most structured approach for a first prototype.

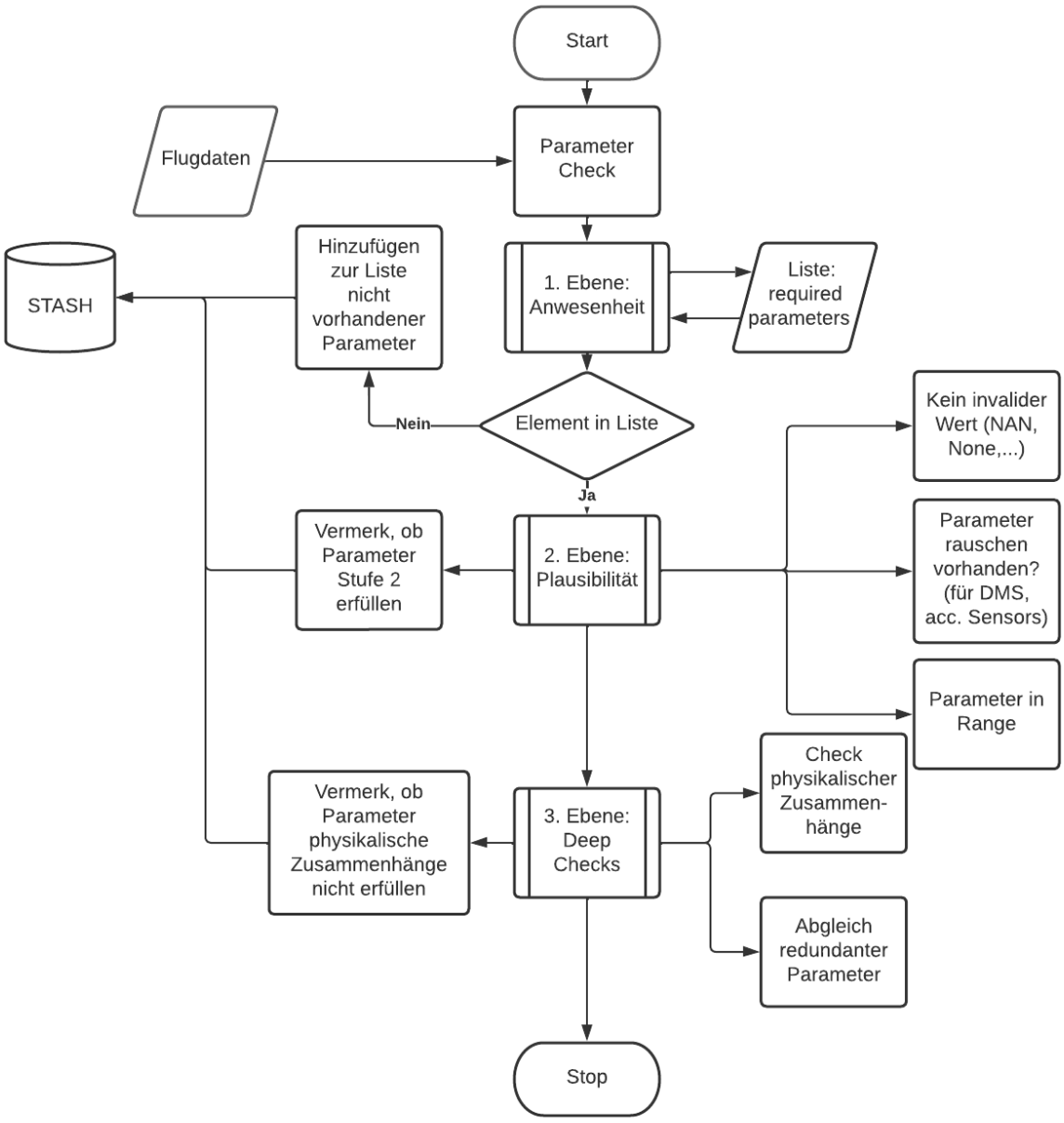

Figure 2.1

2.1 control systems approach

Following the recipe for a modeled aircraft based on sensor data we try to simulate the parameters x and u of the aircraft with the sensor data y. Khaled shows that this approach works for linking omega$_x omega_y, delta_d elta(driftangle) with omega_z$.

To achieve rigorousness... [HEVN04, p. 80]

[HEVN04]

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

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And after the second paragraph follows the third paragraph. Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

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2.2 test-section

And after the second paragraph follows the third paragraph. Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like "Huardest gefburn"? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

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