Bachelor Thesis

for the bachelors degree program in Mechatronics

Development of a Continuous Integration (CI) framework for OptiSlang workflows

In co-operation with

Robert Bosch GmbH

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Abbreviations

CAE ..... Computer-Aided Engineering

GUI ..... Graphical User Interface

MOO ..... Multi Objective Optimization

PIDO ..... Process Integration and Design Optimization

Chapter 1

Introduction

1.1 Overview

This thesis explains about the creation and development of a framework for Optislang workflows. The workflow mostly contains modules created using Python and MATLAB.

1.2 Objective

The objective of this thesis are as follows:

- Develop a method to create a standalone version of MATLAB and Python based modules in Optislang for integration testing (only code based, without using GUI).
- Implement workflows in batch mode.
- Create a framework in Python to create modules and workflows.
- Establish a strategy to for automated integration testing in Github for modules based on Python and MATLAB.

1.3 Outline

- In Chapter 2, we are going to discuss about the MOO project, its role in the company and the modules created in Python and Optislang.
- In Chapter 3, we understand the creation of a framework to create standalone modules and workflows in Python.
- In Chapter 4, we will look into the automated integration testing in Github.
- In Chapter 5, we will discuss the results and evaluate the impact of the solution.
- Finally, Chapter 6 provides us the summary of the work, highlighting the achievements and feedback for development in potential areas.

Chapter 2

MOO Project

2.1 What is MOO?

Multi Objective Optimization (MOO) and Simulation Driven Co - Design is an easy to use method developed for modular, automatized multi domain toolchains considering power loss, thermal calculations and lifetime assessments. In short, MOO is an optimization problem where we have at least two objective functions to optimize simultaneously.

This project is divided into many **action fields** wherein each action field focuses on tackling a defined problem. The table below explains more about each of the action fields.

Action Fields	Objective / Purpose
Co-design, virtual modeling and credible simulation	• Simulation Driven Co-Design as the main method used for product development • Robust design based on costs, performance and reliability
Tools and Automation	• Speed up concept decisions in product development by providing automated simulation workflows • Optimization on system level (function, costs, robustness) • Roll out user-friendly workflows • Robust modeling standards to achieve reproducible results • Integration of available tools
Realistic requirements and confidence of input data	• Definition of realistic requirements(black box) reduced to what is necessary for the MOO • Recording of all design-defining relevant use cases such as active driving, start-up, operation, braking etc • Unify customer requirements to standardize designs
Cross-domain collaboration and qualification - establishing in projects	• Automatized, simulation-based, cost optimum product design in the of Cluster 3 Power Electronics • Optimal design decisions

Table 2.1: Action fields and Objectives of MOO

2.2 Modules and Workflows

2.3 What is Optislang

Ansys Optislang is a framework for design exploration, Computer-Aided Engineering (CAE) based sensitivity analysis and optimization in conjunction with any product development tool. It is a Process Integration and Design Optimization tool or in short, a PIDO tool. Process Integration means to automate and orchestrate manual simulation processes and to realize complex workflows. Design Optimization aims for better understanding of your design, optimizing the product, identify an improved design which has the desired qualities and resulting in a best design by reliability analysis and statistical analysis.

Optislang uses several solvers to look into aspects like mechanical, technical, mathematical and any other problems. This is easier in Optislang as it provides integration to create toolchains of many external programs like ANSYS, MATLAB, Excel, Python, CATIA and many more.

Bibliography