

Beyond Control Code: Uncovering the Procedures Behind Industrial Automation

Master's Thesis

in cooperation with the Corporate Research Center of ABB in Mannheim, focusing on the extraction and modeling of procedures from industrial automation code

Motivation

Industrial PLC code contains a wealth of implicit knowledge about system behavior, including both standard procedures and responses to unexpected events. Understanding these embedded procedures is essential for developing realistic training scenarios in Operator Training Simulators (OTS). As automation increases, operators must still grasp how the system reacts—even when they are no longer directly controlling it. Extracting and modeling these procedures from control code can provide a valuable foundation for scenario generation and operator preparedness.



Objectives

In this thesis, you will have the opportunity to explore how procedural knowledge—such as start-up routines, shutdown sequences, and system responses to specific conditions—is embedded in industrial control code. You will get to dive into real-world PLC programs, understand how automation systems behave, and develop your own approach to identifying and modeling these procedures. Along the way, you will explore and compare different analysis strategies to determine which methods are most effective for capturing relevant operational behavior. By the end of the thesis, you will demonstrate your approach through a prototype that puts your ideas into practice

Key tasks include:

- Familiarization with PLC programming, control systems and code analysis
- Analysis of real control code (provided by **ABB**)
- Development and comparison of analysis strategies
- Identification and modeling of procedures

Interests and Helpful Prior Knowledge

- ⚙️ Great interest in industrial automation (control code etc.) as well as information modelling
- 💻 Feeling comfortable to work (independently) with code and engineering concepts
- 📖 Lectures like Cyber-Physical Modeling and lectures on Industrial Automation
- 🏢 Willingness to conduct the thesis **on-site at the **ABB** Research Campus in Mannheim**



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