



## **VOLVO PENTA**

# **Software in the Loop (SiL) based on Machine Learning Models for Electric Powertrains**

### **Thesis Background**

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The expansion of mobility trends - Autonomous, Connected, Electrified, and Shared (ACES) represents a game changer for the automotive industry. To remain competitive in the global market, the companies are shifting focus to the earlier stages in the development process to tackle the ever-increasing complexity of modern powertrains and insure the product quality, while shortening lead times and decreasing the overall costs. These objectives can be achieved by using **X-in-the-Loop (XiL)** simulation environments in **real-time (RT)** – **X=M-model, S-software, H-hardware** – throughout different phases of the development process.

Sophisticated control strategies are optimized and validated in SiL (RT system & controller model), HiL (RT models interfacing with actual hardware) configurations before being implemented in an actual powertrain. Having a common simulation tool in these two stages is of great advantage for the systematic process that ensures reusability and inheritance, as well as identification and straightforward tracking of errors.

### **Thesis scope of work**

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This work is focused on development of the SiL platform, which is central in the development phase for optimization and parametrization of control strategies for electric powertrains. The focus is on developing robust and accurate computational models capable of handling development issues together with new approaches to el-powertrain system optimization. Machine Learning (ML) algorithms, such as Neural Networks (NN), are pivotal to development of such models for predicting optimal real-time energy management strategies.

MATLAB-Simulink textual/graphical programming environment will be used to create such platform, making it possible organize the system into different blocks and get a clear overview of subsystems/components and their performance.

### **Qualifications & Required Documents**

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- Two students with a background in mechatronics, signal and systems, automotive engineering or similar
- Knowledge of machine learning is considered advantageous
- Programming, Matlab, Simulink

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Please send your application including CV, Cover Letter, and Transcript of grades.

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## Practical information

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**Thesis Level:** Master (30 ECTS points)

**Language:** English

**Starting date:** January 2019

**Number of students:** 2 students

**Last application date:** December 1<sup>st</sup>, 2018

**Examiner proposal:**

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## Contact

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## About us

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With Volvo Penta, a world-leading supplier of engines and complete drive systems for marine and industrial applications, you will be part of a global and diverse team of highly skilled professionals who works with passion, trust each other and embraces change to stay ahead. We make our customers win.



In new Technology Development, our mission is to develop and deliver new innovative solutions and driving Volvo Penta transformation towards future technology. We are a light setup with few own resources, but with a budget and mandate over a large number of appointed resources. We are an agile and scalable entity that adapt over time to reflect the changing needs. We deliver Technology strategy, Innovation and Mature technology ready for product projects.

**Entity:** AB Volvo Penta

**State / Province:** Västra Götaland

**City/Town:** Göteborg

**Employment/Assignment Type:** Thesis

**Functional Area:** Technology

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