On the hunt for thesis work?

The BorgWarner PowerDrive Systems business unit is a leading supplier of advanced electrification technologies, innovative torque management products and systems, and rotating electrics for vehicle manufacturers around the world.

BorgWarner i Landskrona utvecklar och tillverkar system och komponenter till de största fordonstillverkarna världen över. Vi är en del av PDS (Power Drive Systems) vars vision och mål är att uppfinna och utveckla rena och energi-effektiva system för framdrivning av förbrännings-, hybrid- och framförallt elektriska fordon.

BorgWarner in Landskrona develops and manufacture systems and components to the largest passenger vehicle manufacturers in the world. We are a part of PDS (Power Drive System) with the vision and goal to invent and develop clean and energy-efficient systems for propulsion of combustion, hybrid and electric vehicles.

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Content

Software Verification – How can AI be used in software testing?

Background

In the software verification area, there is a lot of requirements and corresponding testcases. How can we use AI to optimize what to verify and maximize the quality in the build.
Some testcases can be unstable due to timing requirements that our test benches not always can met and thereby give false result. In those cases, would it be possible for an AI for detecting if a run of an unstable testcase resulted in valid result or if the test should be rerun instead of a tester having to make that decision.

Today we base what to verify on experience and what area changed. The high level of automated testcases makes this a complex task. Can AI help create test suite based on results from nightly runs, the changed functionality?

Challenge

- Is it possible to see patterns in the result
- How can AI be beneficial in this area
- What metadata for the build and from test environment to make test suite suggestions
- What is the draw back
- Is it possible to use an AI to suggest a custom test suit for a nightly run to maximize our test benches.

The work will preferably be conducted at BorgWarner in Landskrona and is suitable for 1-2 persons.

Knowledge of AI is required.

Reporting

The master thesis shall be reported as a written report, a complete test environment and an oral presentation at BorgWarner.

Contact Person

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BorgWarner

Software Verification – Next generation modular test rig using EtherCAT

Background

Energy efficiency and CO2 reduction are two of the main focus areas when we develop the driveline systems for the future. Systems utilizing this can come in different shapes and sizes.

A modular test rig base that can be configured to fit the different projects in an easy and modular way is needed. The current generation of test rig do not have this modularity in the rig software. Is it possible to achieve this with the current tool chain and Ethercat?

Challenge

- How to make every module independent
- Vector hardware with Ethercat
- Bechhoff Ethercat modules
- Rig backbone communication
- Modular woer

The work will preferably be conducted at BorgWarner in Landskrona and is suitable for 1-2 persons.

Knowledge of electrical design is required.

Reporting

The master thesis shall be reported as a written report, a complete test environment and an oral presentation at BorgWarner.

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BorgWarner

Machine Learning for BLDC motor control

Background

BorgWarner is an automotive supplier with headquarters outside of Detroit, USA. At the site in Landskrona, drivetrain- and four-wheel-drive systems are developed and produced for passenger vehicle manufacturers around the world.

BorgWarner Landskrona has several applications of actuators using a Brushless DC, permanent magnet motor in different actuators. During last years, Machine Learning has become a hot topic, and we believe there could be a possible potential for using Machine Learning for motor control in BorgWarner actuators. A permanent magnet BLDC motor is controlled by sending currents through different coils. Then, a magnetic field is obtained which is applied in different directions to get the shaft with a permanent magnet to rotate. Field oriented control (FOC) is one of the main control approaches, where a typical FOC scheme consists of two inner current loops and one outer speed loop.

Proportional-integral (PI) controllers are commonly used to regulate the motor currents. But there are some ways we believe Machine Learning could be tested to possibly improve the motor control in our actuators. One idea is to replace PI controllers as well as the currently used PWM technique with a neural network, as the PI controllers cannot fully compensate for nonlinearities in the motor.

Tasks

- Implement and validate a simple model of the permanent magnet BLDC motor.
- Implement a Machine Learning strategy for motor control of a BLDC motor.
- Compare the implemented control strategy to the Field-Oriented Control implementation used in actuators today.

The master thesis shall be performed at BorgWarner, Landskrona.

Prerequisites: Control Theory, Machine Learning, MATLAB Simulink.

Result

The thesis outcome should be a written report, simulation models, comparison between ML motor control strategy and FOC and an oral presentation at BorgWarner.

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Estimation of Pressure in an All-Wheel-Drive system

Background

BorgWarner is an automotive supplier with headquarters outside of Detroit, USA. At the site in Landskrona, drivetrain- and four-wheel-drive systems are developed and produced for passenger vehicle manufacturers around the world.

One of the products BorgWarner is developing in Landskrona is an All-Wheel-Drive (AWD) system, which is actuated using a hydraulic pump. An important property of the hydraulic system of the AWD is the pressure producing a torque. Since the pressure cannot easily be measured, it needs to be estimated from other available signals, such as the speed of the actuator or the current.
BorgWarner is looking to improve the accuracy of the estimated pressure, and we believe that there is a potential for using machine learning techniques to capture non-linear dynamics that are not included in the current estimation model.
It is therefore interesting to develop a model estimating the pressure in the hydraulic AWD system from measured data using Machine Learning techniques and comparing the estimation to the current model.

Tasks

- Collect data needed for the estimation model by measuring on a test-stand.
- Implement and validate a nonlinear model estimating pressure from other data (e.g., motor speed, current) using a Machine Learning strategy using MATLAB / Simulink.
- Compare the implemented estimation model with the existing model.

The master thesis shall be performed at BorgWarner, Landskrona.

Prerequisites: System Identification, Machine Learning, MATLAB Simulink, Mathematical Modelling.

Result

The thesis outcome should be a written report, simulation models, and an oral presentation at BorgWarner.

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BorgWarner

Continuous Integration – Report Aggregation

Background

A continuous integration system consists of many pipelines that produces various documents and reports. Data from different sources needs to be collected to be able to display project metrics and progress.

Challenge

- Examine and understand the needs
- Do a market analysis of available tools
- Propose tools that fulfills the needs
- Create a demo implementation based on BorgWarner pipelines and proposed tools.

The work will preferably be conducted at BorgWarner in Landskrona and is suitable for 1-2 persons.

Knowledge of CI/CD or Jenkins is preferred.

Reporting

The master thesis shall be reported as a written report, a demo implementation, and an oral presentation at BorgWarner.

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Are you interested in thesis work within another area?

We also can offer thesis work within other areas such as production technology, logistics, purchasing, marketing, business development and quality.

Send your application with CV and personal letter to Henrik Värmfors from HR, hvarmfors@borgwarner.com with a description of your ideas.

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