

Sensorless FOC and position estimation

Background

BorgWarner is an automotive supplier developing clean and efficient technology solutions for hybrid, electric and combustion vehicles. At the site in Landskrona, driveline and propulsion systems are developed and produced for manufacturers around the world.

BorgWarner Landskrona has several applications of actuators using a Brushless DC, permanent magnet motor in different actuators. In some applications it is important to know the position of the motor, to determine whether the shaft driven by the motor is connected or not. Currently the motor has an extra permanent magnet and a position sensor to measure the position. This is a cost that could be reduced if the position could be estimated.



There are different methods to estimate rotor position needed for with Field Oriented Control (FOC). For our applications it is important to measure position both when the motor is running fast but also when the motor is slow and at standstill. The purpose here is to implement at least two different methods of estimating the rotor position from available signals, compare and investigate advantages and disadvantages of those methods in different situations (e.g. standstill, fast speed, used for FOC).

Feel free to contact us if you are interested and want to know more about our ideas for this thesis proposal.

Tasks

- Investigate at least two approaches to estimate the rotor position from available data.
- Implement these methods and evaluate and compare them for control of a BLDC motor.
- Compare the performance of these methods with the case when there is a sensor.

The master thesis shall be performed at BorgWarner, Landskrona. We prefer that two students write the thesis together. Students will get a compensation for completed master thesis, and lunch will be paid by BorgWarner.

Prerequisites: MATLAB Simulink and knowledge in at least one of the areas of power electronics, time series analysis or control theory/system identification.

Result

The thesis outcome should be a written report, implementation of at least two algorithms for position estimation, evaluation of the algorithms and an oral presentation at BorgWarner.

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Simulation model of a BLDC motor

Background

BorgWarner is an automotive supplier developing clean and efficient technology solutions for hybrid, electric and combustion vehicles. At the site in Landskrona, driveline and propulsion systems are developed and produced for manufacturers around the world.

BorgWarner Landskrona has several applications of actuators using a Brushless DC, permanent magnet (BLDC) motor in different actuators. In order to improve development and testing of control strategies, the objective of this thesis is to develop a way to estimate motor parameters from measured data for a model of a BLDC motor.



Tasks

- Investigate approaches to estimate the motor parameters from measured data.
- Implement at least one estimation approach.
- Collect measurements on a BLDC motor to verify the approach.

The master thesis shall be performed at BorgWarner, Landskrona. We prefer that two students write the thesis together. Students will get a compensation for completed master thesis, and lunch will be paid by BorgWarner.

Prerequisites: MATLAB Simulink, System Identification

Result

The thesis outcome should be a written report, implemented simulation model, implemented method for estimation of motor parameters and an oral presentation at BorgWarner.

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Development of a Temperature Estimation model

Background

BorgWarner is an automotive supplier developing clean and efficient technology solutions for hybrid, electric and combustion vehicles. At the site in Landskrona, driveline and propulsion systems are developed and produced for manufacturers around the world.

For some of the products developed, the performance is depending on the temperatures of the components and the oil. Since not all temperatures can be measured, it is important to accurately estimate the needed temperatures from available measurements. The purpose of this thesis is to update the existing model to better estimate temperatures in newer products. This includes analyzing temperature development in different parts of the system and from this implementing an estimation model for the temperatures.



Tasks

- For different parts of the system, investigate the temperature development and what drives it.
- Develop a model that can estimate the important temperatures in the system and implement this model.
- Test the model against measured data.

The master thesis shall be performed at BorgWarner, Landskrona. We prefer that two students write the thesis together. Students will get a compensation for completed master thesis, and lunch will be paid by BorgWarner.

Prerequisites: Control Theory, System Identification and/or Machine Learning, MATLAB Simulink.

Result

The thesis outcome should be a written report, simulation models, implementation of (at least) one method to automatically tune the model parameters and an oral presentation at BorgWarner.

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Examination of losses and motor control

Background

BorgWarner is an automotive supplier developing clean and efficient technology solutions for hybrid, electric and combustion vehicles. At the site in Landskrona, driveline and propulsion systems are developed and produced for manufacturers around the world.

BorgWarner Landskrona has several applications of actuators using a Brushless DC, permanent magnet motor in different actuators. The idea with this thesis proposal is to investigate mainly how the motor control could be improved to minimize losses and achieve a higher efficiency in the Gen6 BLDC motor. There exist a CAD-model of this motor that can be used to calculate efficiency depending on how the current is controlled by the motor controller. This way it is possible to calculate efficiency of the motor with our existing implementation of motor control and compare this with another updated motor control strategy.



Tasks

- Investigate losses in the motor used for BorgWarner Gen6 actuators.
- Evaluate motor control strategies by analyzing losses.

The master thesis shall be performed at BorgWarner, Landskrona. We prefer that two students write the thesis together. Students will get a compensation for completed master thesis, and lunch will be paid by BorgWarner.

Prerequisites: Power electronics, electrical machines, and motor control.

Result

The thesis outcome should be a written report, evaluation of losses in relation to motor control strategy in BorgWarner Landskrona Gen6 motor and an oral presentation at BorgWarner.

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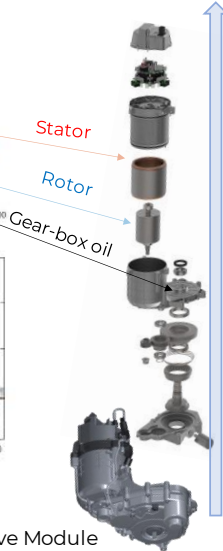
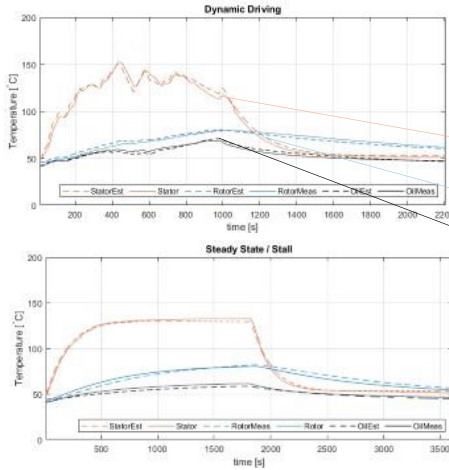
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Temperature Modeling and calibration for Thermal Management

Virtual sensors based on physical modeling and data -driven calibration



48V Drive Module

Online-Estimation of Drive-module temperatures enables:

- Sensorless derating and high -temperature protection.
- Improved torque accuracy.
- Improved coolant -flow control.

Model development/calibration:

- Derive thermal models from first principles.
- Data collection from rig and vehicle testing with additional sensors.
- Automatic parameter calibration through mathematical optimization.

- *This project could also be done with Machine Learning.*

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