Simulink Powertrain Blockset Model

Progress and Documentation

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For detailed references and help, click the **help** button located at the bottom right of each parameter window in Simulink

This progress and documentation guide is generally organized as follows: a general description of the overarching system; a general description of any subsystems; a list of parameters grouped by tab and their status for subsystem blocks. Each subsection contains an appendix with relevant data, figures, and resources used for parameterization so as to develop a robust, traceable, and replicable model. Each resource is labeled as A# and corresponds only to the relevant system the appendix is located in.

1. **Electric Plant**

The electric plant portion of the model includes the **battery** and the **motor**.

**Battery (Datasheet battery)**

The battery model is implemented base off discharge characteristics at different temperatures. It is most likely that the battery parameters are for a single cell. To generate parameter data: [Generate Parameter Data for Datasheet Battery Block](https://www.mathworks.com/help/autoblks/ug/generate-parameter-data-for-datasheet-battery-block.html)

Percentage Parameterized: 0%

Parameters

1. Rated capacity at nominal temperature, BattChargeMax [Ah]: Not parameterized
2. Open circuit voltage table data, Em [V]: A 1-D lookup table of voltages at specific discharge capacity breakpoints plotted against iii (see below); Not parameterized
3. Open circuit voltage breakpoints 1, CapLUTBp: Discharge capacity breakpoints used to plot ii; Not parameterized
4. Internal Resistance table data, RInt [Ohms]: A 2-D lookup table of internal resistance at specific temperatures (v) and states of charge (vi); Not parameterized
5. Battery temperature breakpoints 1, BattTempBp: Battery temperature breakpoints used to plot iv; Not parameterized
6. Battery capacity breakpoints 2, CapSOCBp: battery capacity breakpoints used to plot iv; Not parameterized
7. Number of cells in series, Ns: Not parameterized
8. Number of cells in parallel: Not parameterized
9. Initial battery capacity, BattCapInit [Ah]: Not parameterized

**Motor**

There are two variants of the motor: **MotGenEvMapped**, a representation of the motor as a map between maximum torque (Nm) and maximum power (W), and **MotGenEvDynamic**, a mathematical model of the **motor controller**, **inverter**, and **motor**. The current model uses **MotGenEvDynamic**.

**Interior PM Controller**

A representation of a motor controller for an interior permanent magnet motor.

Motor Parameters

1. Stator resistance, Rs [Ohm]: Parameterized, A1
2. D-axis inductance, Ld [H]: Parameterized, A1
3. Q-axis inductance, Lq [H]: Parameterized, A1
4. Permanent magnet flux, lambda\_pm [Wb]: Parameterized, A1
5. Number of pole pairs, PolePairs: Parameterized, A1

Id and Iq Calculation

The Id and Iq Calculation involves a set of derived parameters calculated by pressing the “Calculate MPTA Table Data” button. Only the first two parameters are actually entered by hand.

Parameters

1. Maximum torque, T\_max [N.m]: the maximum torque of the motor, currently set at 100 as a rough average of peak and continuous torque; Parameterized, A1
2. MTPA table breakpoints: the number of breakpoints to use in the derived parameterers; Parameterized

Current Controller

Relevant information could not be found for any of the parameters in this section.

**Motor Appendix**

A1. [EMRAX 208 Techincal Data Table](https://emrax.com/wp-content/uploads/2020/03/emrax_208_technical_data_table_graphs_5.4.pdf); high voltage column