

Self-Commissioning - Description

Preface

Self-Commissioning is a process that is designed with a primary objective of estimating motor parameters. As a secondary objective, it also encompasses processes that calibrate for errors in hardware parameters relative to their design values. This calibration step helps improve the accuracy of estimated parameters. The motor parameters and hardware calibration parameters generated by Self-Commissioning are used by motorBench™ Development Suite to compute gains in Autotuning and for determining other numerical parameters used in the Motor Control Application Framework.

Salient Features

The following points summarize the features of the Self-Commissioning process:

1. Measures motor parameters (in the following sequence)
 - a. Stator phase resistance (R_S)
 - b. Stator phase inductance in direct and quadrature axes (L_Q and L_D)
 - c. Back-EMF constant (K_E)
 - d. Viscous damping factor (B) – includes mechanical load
 - e. Static friction torque (T_F) – includes mechanical load
 - f. Rotor inertia (J) – includes mechanical load
2. Motor parameter measurement
 - a. Does not require any external assistance such as clamps, pulleys, inertia loads, etc.
 - b. Does not require a torque sensor
 - c. Does not require position or speed sensor (example: QEI, Hall effect, etc.)
3. Measurement process requires no intervention from the user, except for cases when a fault occurs
4. Measurement process requires a minimum set of nameplate parameters of the motor and hardware parameters (PWM deadtime, PWM frequency, DC link voltage, etc.)
5. Optionally, performs a board calibration procedure to determine and compensate for tolerances/errors in hardware parameters. If performed, this helps in improving the measurement accuracy while determining the motor parameters. The calibration factors for following hardware parameters are measured by the board calibration feature:
 - a. Current sense amplifier offset bias error
 - b. Current sense amplifier gain error and
 - c. Bus voltage measurement scaling error.

Limitations

The latest version of Self-Commissioning has the following limitations:

1. Mechanical load that is attached to the rotor must be stable and must not contribute to a wobble or provide varying torque over mechanical angle.
2. Electrical properties of the motor, mechanical properties of the motor and its mechanical load should not change or drift over time during the Self-Commissioning analysis.
3. Motors with base speed specification greater than 32760 electrical RPM are not supported.
4. Motor with very high cogging torque may cause the Self-Commissioning Analysis to fail. This includes motors that are connected to mechanical loads that require a startup torque current of >100% motor rated continuous current (ex: compressors, etc.).
5. Motors with very high or very low inductance may cause Self-Commissioning to fail, or may negatively impact accuracy of measurements. Based on the 10 different motors that we have tested with, motors with stator inductance <100 μ H or stator inductance >3mH fall under this category.

6. During the Self-Commissioning analysis, measurements are performed when the motor appears to be stationary as well as when it is spinning – hence, the motor must not be moved/disturbed any point of time during the analysis.
7. We recommend using a stable power supply that varies by less than 1% with the load required to spin a motor at its base speed. Variation of power supply voltage will degrade the accuracy of measurements.

Revision History

Version	Date	Author	Description
1	24/Feb/2017	Srikar Deshmukh - C14317	First revision of the document