MTB – Motor testbench

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The MTB block is a simulation model included in the [Imperix Power library](#). It models the imperix [motor testbench](#) in Simulink and PLECS simulation.

For more information regarding the Imperix Power library, please read [Getting started with Imperix Power library](#).

Imperix Power library is available starting from ACG SDK 2024.2. Simulink Simscape Electrical or PLECS is also required. The Simulink version is only compatible with Specialized Power Systems. The supported versions are:
• Simulink R2016a or newer.
• Plexim PLECS 4.5 or newer.

Modeling of MTB

The Motor Testbench features a squirrel cage Induction Machine (IM) and a Permanent Magnet Synchronous Machine (PMSM). One machine is the device under test while the other one acts as a controllable load. The schematic is shown below.
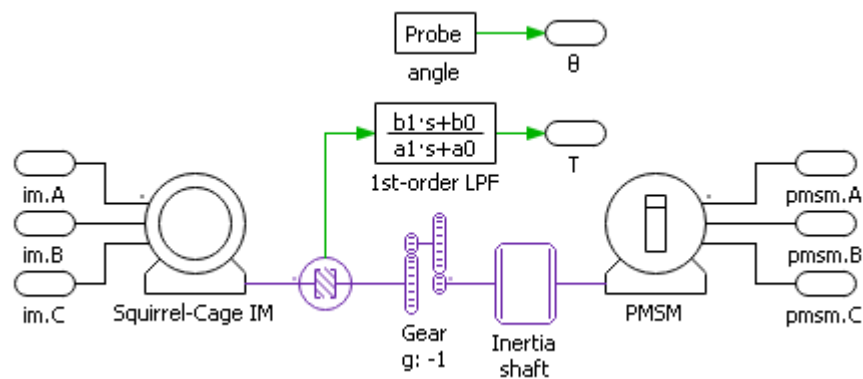
The MTB model has one modeling level:

- **(A) Simple**

For more detailed model parameters and measurement results, please contact .

Machine parameters

All the parameters of the machines are summarized in the following tables.

Item	Symbol	Value
Pole pairs	p	4
Moment of inertia	Jm	40.6e-4 kg.m^2
Friction coefficient	kF	30.35e-5
Stator resistance	Rs	0.559 Ω
Stator inductance	Ls	4.24 mH
Stator inductance along d-axis	Ld	4.24 mH
Stator inductance along q-axis	Lq	4.24 mH
Flux from permanent magnets	Phi_pm	0.2748 Nm/Apk

Parameters of PMSM

Item	Symbol	Value
Pole pairs	p	4

Item	Symbol	Value
Moment of inertia	Jm	178e-4 kg.m^2
Friction coefficient	kF	30.35e-5
Stator resistance	Rs	1.24 Ω
Rotor resistance	Rr	0.73 Ω
Stator leakage inductance	Lgs	11.5 mH
Rotor leakage inductance	Lgr	11.5 mH
Mutual inductance	Lm	183 mH

Parameters of IM

| Item	Symbol	Value
Moment of inertia shaft	Jm_shaft	54.7e-4 kg.m^2

Other parameters

Sensors

The motor testbench features an angle resolver and a torque sensor. The angle resolver is modeled by an ideal sensor with the angle initialized at 0, while the torque sensor is modeled by an ideal sensor with a 1kHz low-pass filter.
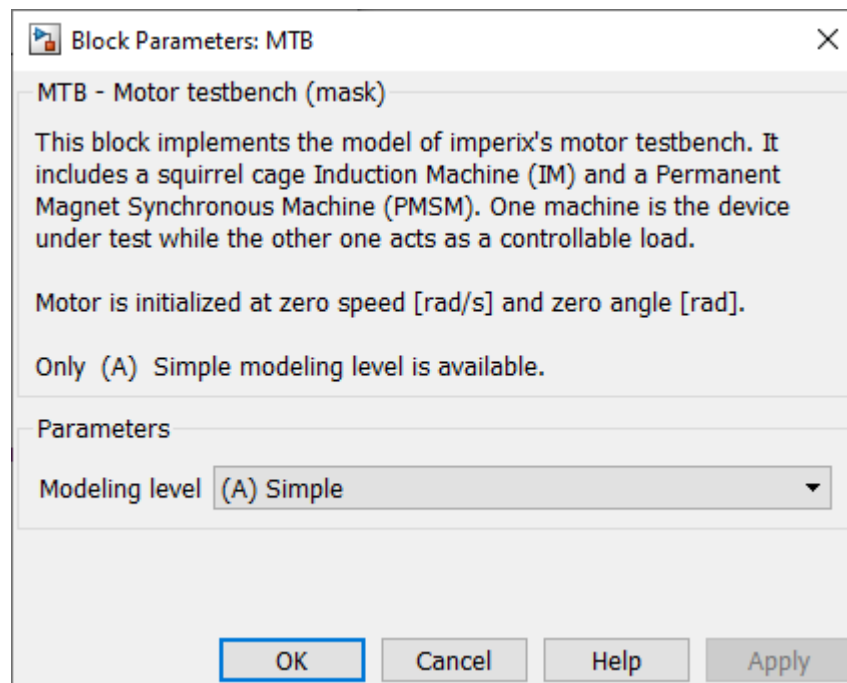
Simulink MTB block

Port specification

- The output `T` is the measured torque.
- The output `θ` is the measured rotor angle.
- The connection ports `im.A,im.B,im.C` are the electrical ports connected to the three-phase AC input of the IM.
- The connection ports `pmsm.A,pmsmm.B,pmsm.C` are the electrical ports connected to the three-phase AC input of the PMSM.
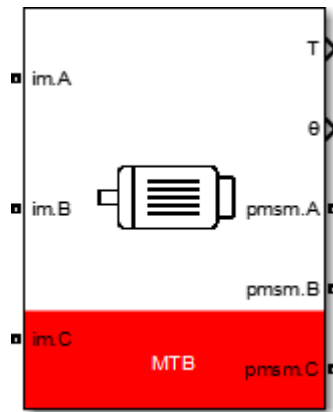
Parameters

- `Modeling level` selects the modeling level.

PLECS MTB block

Port specification

- The output `T` is the measured torque.
- The output `θ` is the measured rotor angle.
- The connection ports `im.A,im.B,im.C` are the electrical ports connected to the three-phase AC input of the IM.
- The connection ports `pmsm.A,pmsmm.B,pmsm.C` are the electrical ports connected to the three-phase AC input of the PMSM.
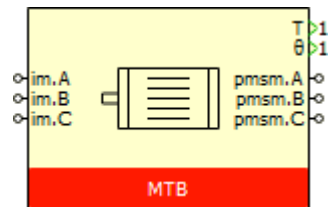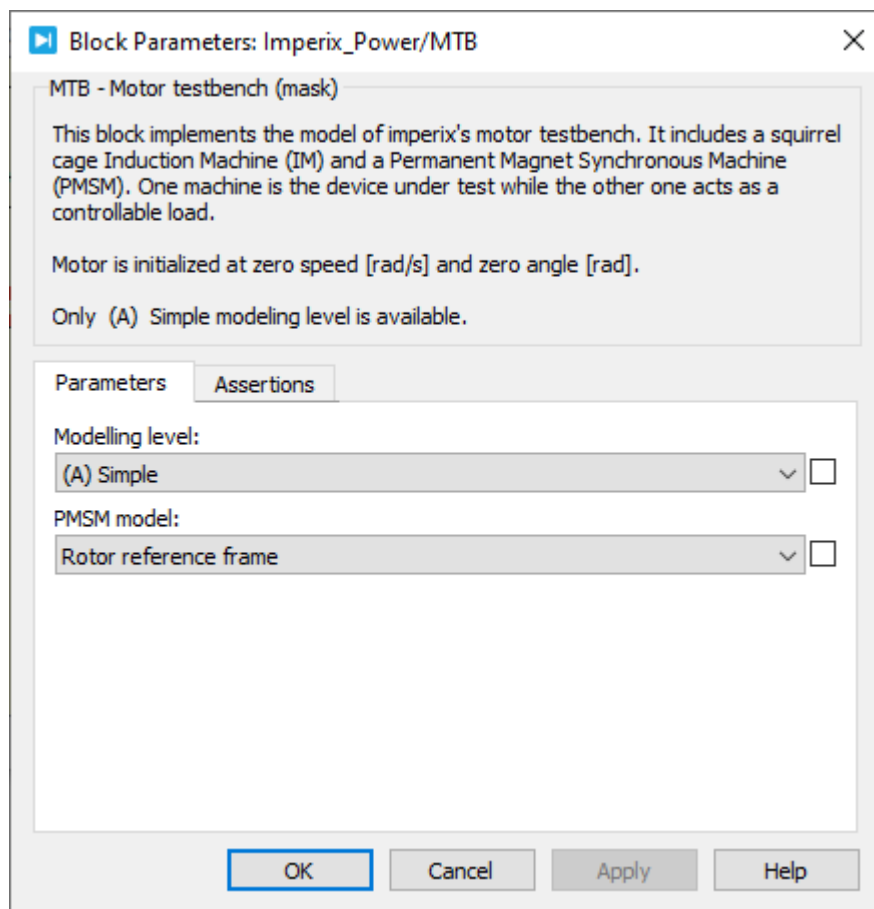
Parameters

- `Modeling level` selects the modeling level.
- `PMSM model` selects the model of PMSM. The PMSM can be either implemented in the rotor reference frame or as a voltage behind reactance.

Probe signals

The following signals can be monitored by a Probe block in PLECS.

- `Torque [Nm]` monitors the torque sensor output in Nm.
- `Rotor position [rad]` monitors the rotor position in rad.

Probe Editor: Imperix_Power/Probe   ✕

Probed components

Type	Name	Path
Motor Testbench	Motor Testbench	Imperix_Power

Component signals

☐ Torque [Nm]
☐ Rotor position [rad]

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