

EDrives Key Performance Indicators

Applications

- Multi phase controlled electric drives with phase numbers greater or equal to three
- Redundancy and reliability of electric drives
- Full and hybrid electric vehicles
- More electric aircrafts
- Industrial drives

Modular Levels of Abstraction

Levels of Abstraction

- Quasi static electric machines and power converter (all electrical time transients are neglected)
- Transient electric machines with averaging power converters
- Transient electric machines with switching power converters

Modularity

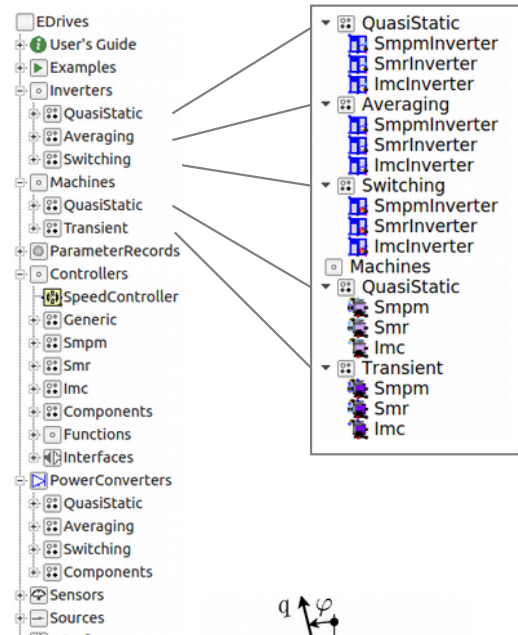
- No re-building of models
- Change level of abstraction by a few mouse click
- Consistent use of parameter records

Further Developments

- Active mains converters with voltage oriented control
- Extended loss models of power converters
- Advanced machine models
- Multi level inverter configurations

Development

- EDrives Library 1.0.0 is available for Dymola
- Depends on Modelica Standard Library 3.2.2
- Copyright by Anton Haumer and Christian Kral
- Visit our homepage at <http://www.edrives.eu>
- Distribution partner <http://www.ltx.de>



All Matching Choices ▾
Browse...

- Quasi static permanent magnet synchronous machine
- Quasi static synchronous machine with reluctance rotor
- Quasi static induction machine with squirrel cage rotor
- Transient permanent magnet synchronous machine
- Transient synchronous machine with reluctance rotor
- Transient induction machine with squirrel cage rotor

.Types.FluxSelection.StatorFlux ▾ Selection of flux orientation

	Tuning of id-controller
	Proportional gain of d-current controller
s	Integral time constant of d-current controller
	Tuning of iq-controller
	Proportional gain of q-current controller
s	Integral time constant of d-current controller
	Integral time constant of flux controller
s	Integral time constant of torque controller

Electric Machines

Included (EMachines library)

- Permanent magnet (PM) synchronous machine
- Synchronous reluctance machine
- Induction machine

Each model is available as

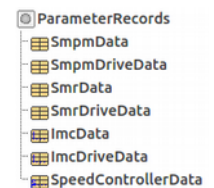
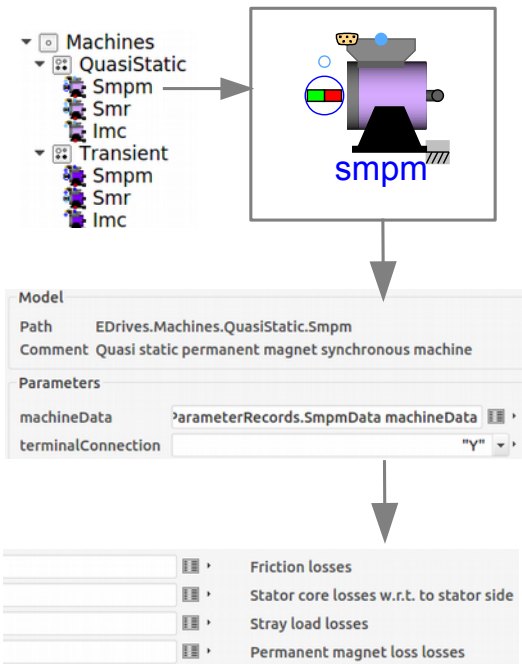
- Time transient model
- Quasi static model (only mechanical transients)

Interfaces

- multi phases electrical connectors for 3,5,6,7,9,10,11,12,13,14,15,17,... phases
- mechanical connectors (flange, housing)
- thermal connector
- comprehensive and consistent loss models

Encapsulation of data

- Parameter records of electric machine data
- Parameter records of entire drive data
- Organization as customer specific data base



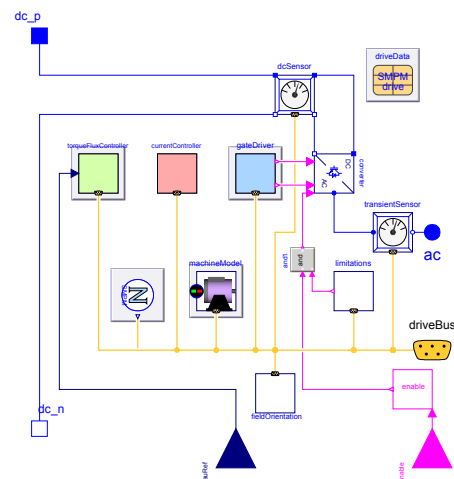
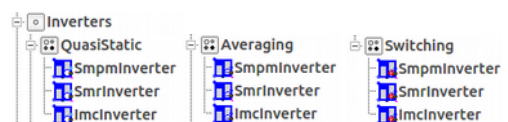
Two Level Inverters

Provided kinds of inverters

- Quasi static
- Averaging
- Switching

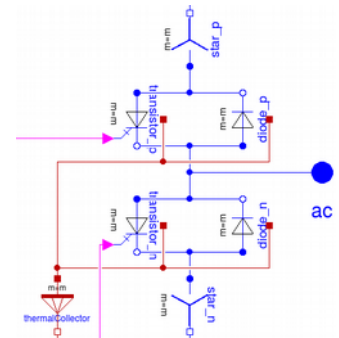
Inverter features

- Integrated field oriented control
- Parameter records to encapsulate data
- Consistent machine state estimation
- Fully compatible with Modelica.Electrical.PowerConverters
- Thermal connector
- Pulse inhibitor



Considered losses (switching converters)

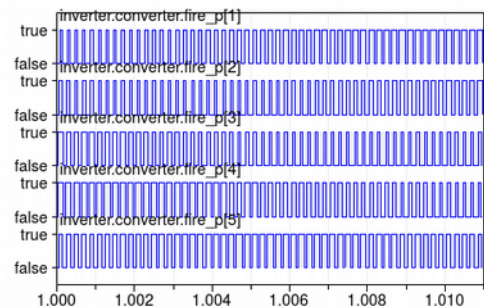
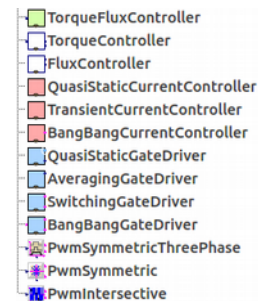
- Diode conduction loss parameters
 - On state resistance R_{on}
 - Off state conductance G_{off}
 - Knee voltage V_{knee}
- Transistor conduction loss parameters
 - On state resistance R_{on}
 - Off state conductance G_{off}
 - Knee voltage V_{knee}
- Thermal connector
- Switching loss models are under development



5	Number of phases
1e-05	Ohm Transistor closed resistance
1e-05	S Transistor opened conductance
0.7	V Transistor threshold voltage
1e-05	Ohm Diode closed resistance
1e-05	S Diode opened conductance
0.7	V Diode threshold voltage
	=true, if heatPort is enabled

Controllers

- Flux controller
 - Stator / main field / rotor flux
 - Flux weakening
- Torque controllers
- Current controller
 - Bang bang
 - PWM
- Pulse width modulation (PWM) strategies
 - Symmetric multi phase space vector PWM
 - Intersective PWM



Example

- Five phase PM synchronous machine
- Symmetrical PWM
- Torque controlled

