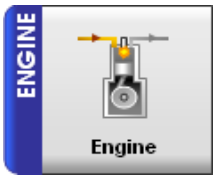
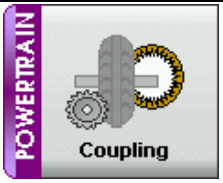
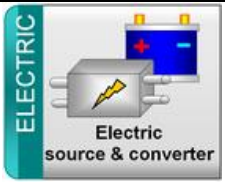
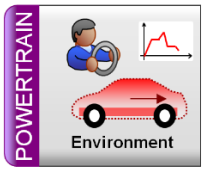
Powertrain

Engine	Electric Machine	Coupling	Electric source / converter	Powertrain Environment	Braking
					

The Powertrain library includes a set of components in mechanic, electric, control domain allowing engineers to develop a complex model of powertrain, with simplified thermal or electric engine, and all type of transmission (manual gearbox, automatic, hybrid).

To build a full demo, a model of driver and a simplified vehicle are also available in this library.

High level of representation is used: model of engine or electric machine, or vehicle are simplified. For further development, Sherpa Engine /Electrical Power system / Mechanic library can be necessary.

Contents

Engine

Simplified engine

[4]

This model gives the motor shaft torque as a function of the engine angular velocity and the engine actuator position. 4 models are available with different parameters, especially to calculate losses torque.

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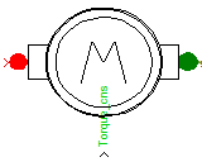
Electric Machine



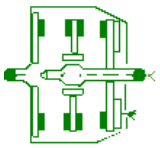
Electric Machine

[2]

This model is an energetic macroscopic representation (torque and power losses are given in a table) of electrical marchine, that is able to operate both as motor (electrical → mechanical) and generator (mechanical →electrical). 2 models are available.

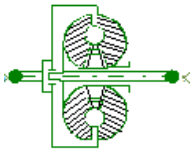
[home]

Coupling



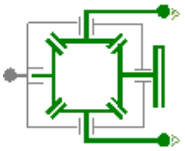
Clutch
[2]

This clutch model computes the torque transmitted by the clutch for a slipping state or an engaged state.



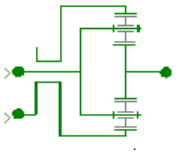
Converter
[2]

This model (use for automatic gearbox) computes the torque transmitted by the converter, considering turbine and impeller velocities. 2 models are available (with or without lock up)



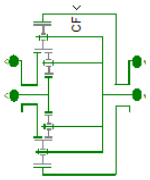
Differential
[4]

The differential model computes wheel left/right from the gear input torque and wheel velocities. 4 models are available (simple / friction / Limited slip / Inverse causality)



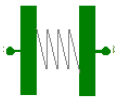
Planetary gear
[2]

This planetary gear model calculates the angular velocity of the Sun from the ring and Planet carrier velocities of the epicyclical gearing. 4 models are available (simple transformation / or model with inertia)



Ravigneaux

The Ravigneaux represents a double planetary gear commonly used in automatic transmissions.

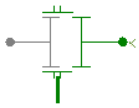


Dual mass Fly wheel

This system consists of two inertias connected by spring and damper (friction) allowing to transmit the torque of the flywheel and to reduce the variations of the torque created by the motor

Dead band

This block is a stiffness/damper set with backlashes. It is an O type resistive element with a common stress in terms of a bond graph representation.

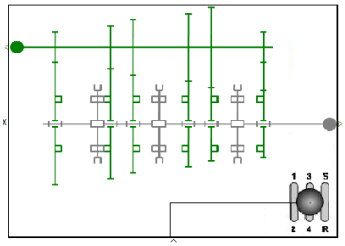


Synchronizer / Lock up
[2]

The synchronizer aims at synchronizing the speed between the motor and the wheels during a speed change. Lock up permits to link 2 inertias.

[home]

Coupling (macro-element)

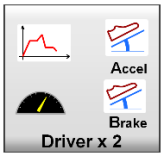


Gear box

This model consists of six reduction gears with different ratios, controlled by one input (desired ratio). Each inertia and synchronizer is included.

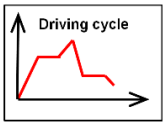
[home]

Powertrain Environment



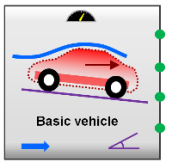
Driver X

This block is a longitudinal driver model (speed regulator that brakes and accelerates)



Driving cycle

This block is a Cycle Vehicle speed setpoint function of time. Many driving cycles are available (ECE 15, EUDC, NEDC…)

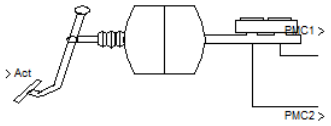


Basic vehicle

Model of longitudinal vehicle dynamics (include aerodynamic force, slope, but not tire slip). For tire slip, use dynamic vehicle model.

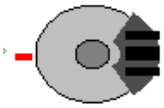
[home]

Brake



Booster/Master cylinder

This block is a simple link between brake pedal and brake pressure.



Brake

[4]

This element is a simple link between brake pressure and brake torque. 4 models are available

[home]

Electric/source converter

Current / voltage source

This block is a simple current or voltage source

Battery

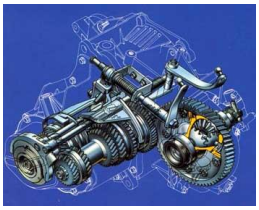
This advanced battery model considers Thevenin model for its electrical dynamic behaviour.

Supercapacitor

This advanced supercapacitor model considers two RC branches, to represent electrical dynamic and internal energy distribution.

[home]

Demos



Manual gearbox

This submodel integrates a manual gearbox with its simplified control, a longitudinal driver model and a simplified vehicle.

Automatic gearbox

This submodel integrates an automatic gearbox (3 gears, with ravigneaux and planetary gear) with its simplified control, a longitudinal driver model and a simplified vehicle.

[home]