Release Notes for SimPowerSystems™

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Release Notes for SimPowerSystems™

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R2012b

Version: 5.7
New Features: Yes
Bug Fixes: Yes

Seven IEEE automatic voltage regulator (AVR) excitation blocks

The Machines library now contains a sublibrary, named Excitation Systems, with seven new blocks. These blocks represent the standard types of IEEE® AVR excitation systems. For more information, see the block reference pages.

The `power_machines` example model, which previously used a generic excitation system, has been updated to use any of the seven models in the Excitation Systems (`AVRlib`) library.

power_new function that creates new Simulink model with recommended settings for SimPowerSystems models

When you type power_new at the MATLAB® Command prompt, the software creates a new model, with the recommended solver ode23tb and with required Solver Configuration and Powergui blocks already on the canvas. It also opens the power_new_palette library.

After using power_new, continue developing your model by copying the blocks from the power_new_palette library, as needed, and adding other blocks from the Simulink® and Simscape™ libraries.

Optional Simscape mechanical rotational port for SimPowerSystems electric drives models

Blocks in the Electric Drives library now have an additional option, `Mechanical rotational port`, for the **Mechanical input** parameter. When you select this option, the mechanical input port of the block (`Tm` or `w`), changes to a Simscape conserving rotational port `S`, which you can connect directly to a mechanical rotational port of a block from Simscape libraries. Therefore, for example, you can model the mechanical part of your system using Simscape and SimDriveline™ blocks, and then connect it directly to the electric drive through the mechanical rotational port `S`. For details, see the block reference pages.

Simscape Interface blocks now permitting user-defined initial conditions

There are several enhancements to the blocks in the Interface Elements library that let you connect SimPowerSystems™ and Simscape electrical circuits:

- Depending on the type of the interface block, you can specify the initial input and output voltage or current in the filter that is used to break an algebraic loop between SimPowerSystems and Simscape circuits. The Current-Voltage Simscape Interface and Current-Voltage Simscape Interface (gnd) blocks now have an additional **Initial Voltage** parameter. The Voltage-Current Simscape Interface and Voltage-Current Simscape Interface (gnd) blocks have an **Initial Current** parameter.
- The **Filter type** parameter in each of these blocks now has two additional values: `First-order input filtering` and `Second-order input filtering`. These options provide access to the input filtering functionality in the underlying Simulink-PS Converter block. For more information, see the Simulink-PS Converter block reference page.
- The block dialog boxes for each of these blocks now have an additional check box, **Show measurement ports**. If you select this check box and click **Apply** or **OK**, the block icon displays an additional port `m`. This is the output port of the underlying voltage or current sensor, depending on the type of the interface block. The Current-Voltage Simscape Interface and Current-Voltage Simscape Interface (gnd) blocks contain a current sensor. The Voltage-Current Simscape Interface and Voltage-Current Simscape Interface (gnd) blocks contain a voltage sensor. The output port `m` provides access to these measurements.

`power_fftscope` function now generating plots directly from MATLAB command prompt, with additional display options

You can now use the `power_fftscope` function directly at the command line, which provides the ability to automate the use of the tool. The THD computation has been improved to include the inter-harmonics in the THD calculations. Two new options are available in the **Display style** drop-down list:

- `Bar (relative to DC component)`
- `List (relative to DC component)`

For more information, see the `power_fftscope` reference page.

`power_lineparam` function accessible programmatically

You can now programmatically access a structure variable with default line geometry parameters, and use it as a template variable to configure a new line geometry and to compute RLC line parameters.

SimPowerSystems blocks supporting Simulink Parameter Objects as dialog box parameters

You can now use Simulink Parameter Objects when entering parameter values into the block dialog boxes. For more information, see “Specify Parameter Values” in the Simulink documentation.

R2012a

Version: 5.6
New Features: Yes
Bug Fixes: Yes

Simscape Rotational Port Available as Mechanical Input for Machine Blocks

The **Mechanical input** parameter has a new option, `Mechanical rotational port`, which has been added for the following machines:

- Simplified Synchronous Machine
- Synchronous Machine
- Asynchronous Machine
- Single Phase Asynchronous Machine
- DC Machine
- Permanent Magnet Synchronous Machine

When you select this option, the mechanical input port of the block (`Tm` or `w`), changes to a Simscape conserving rotational port `S`, which you can connect directly to a mechanical rotational port of a block from Simscape libraries. This allows you, for example, to model the mechanical part of your system using Simscape and SimDriveline blocks, and then connect it directly to the electrical machine through the mechanical rotational port `S`. See the block reference pages for details.

New Setup Function for Permanent Magnet Synchronous Machine Block

The `power_PMSynchronousMachineParams` function lets you compute parameters of a Permanent Magnet Synchronous Machine block based on standard manufacturer specifications. It lets you input manufacturer data and returns the computed machine parameters, along with additional derived data such as synchronous speed, number of pole pairs, nominal slip, starting torque, and so on. The function also lets you display relative errors between the input manufacturer data and the equivalent data obtained with the computed parameters. The function comes with a graphical user interface that allows you to compute the block parameters and apply it to selected block, as well as display the detailed results in the Command window.

Additional Solver Type Option Available for Discrete Mode

When you set the **Simulation type** parameter of the Powergui block to `Discrete`, the dialog box now contains a new parameter, **Solver type**, which lets you select between `Tustin` and `Backward Euler` options. `Tustin` is the method used in previous versions. It is still the default, therefore there is no compatibility impact on existing models. If your model shows numerical oscillations upon simulation in discrete mode, using `Backward Euler` method to discretize the state-space matrices may help eliminate the oscillations.

Distributed Resources Library Renamed to Renewable Energy

The Distributed Resources block library has been renamed, and is now called Renewable Energy library. All the block names are the same, and there is no compatibility impact on existing models.

New SimPowerSystems Demos

The following demos have been added in Version 5.6:

Demo Name	Description
Mechanical Coupling of Synchronous Generator with Exciter System Using the Simscape Mechanical Rotational Port (`power_SM_exciter_SSC`)	This is a modified version of the Mechanical Coupling of Synchronous Generator with Exciter System (`power_SM_exciter`) demo. It illustrates how using the new `Mechanical rotational port` option for mechanical coupling of an excitation system simplifies the model.
Initializing a 29-Bus, 7-Power Plant Network With the Load Flow Tool of Powergui (`power_LFnetwork_29bus`)	Illustrates the use of the Load Flow tool of Powergui to initialize a 29-bus 735 kV network with detailed modeling of power plants using hydraulic turbines, speed regulation, excitation systems, and power system stabilizers.

R2011b

Version: 5.5
New Features: Yes
Bug Fixes: Yes

SimPowerSystems Software Now Requires Simscape Product

SimPowerSystems software now depends on and requires Simscape software, the foundation for Physical Modeling products. Simscape software includes common Physical Modeling utilities and block libraries. See the Simscape documentation for details.

SimPowerSystems block libraries are now located under the **Simscape** node in the Library Browser.

Interfacing with Simscape Electrical Domains

Four blocks in the new Interface Elements library allow you to connect a SimPowerSystems electrical connection line to a Physical Networks line connected to Simscape blocks. These blocks have SimPowerSystems ports on one side and Simscape ports on the other, and transfer voltage and current as Physical Networks Across and Through variables, respectively, without energy loss.

Sharing Models Using Simscape Editing Modes

SimPowerSystems software now features a selection of two Simscape editing modes that allow full or restricted editing of models.

- The Restricted mode requires SimPowerSystems product to be installed, but does not require a license. It allows you to change a limited set of model parameters, but not the blocks or connections, in a SimPowerSystems model.
- The Full mode requires SimPowerSystems product to be installed with a license. It allows you to change anything in a SimPowerSystems model.

For more details, see About the Simscape Editing Mode .

Block Library Links Must Be Resolved

Compatibility Considerations: Yes

All core SimPowerSystems blocks in your models must now have resolved block library links. You can neither disable nor break these library links. This is a global Simscape requirement. Consult the Simscape documentation for further details.

This restriction does not apply to the blocks from Application libraries (Electric Drives, Distributed Resources, and FACTS) and the Extra library.

Compatibility Considerations

If you have an existing SimPowerSystems model with disabled or broken links from the blocks in the model to the SimPowerSystems block libraries (other than the Applications and Extra library), you must restore all the broken block library links for your model to be valid.

If you have disabled or broken the SimPowerSystems library link for blocks that you have customized and want to keep these modified blocks in your model, you must move these modified blocks to your own custom library or libraries, then copy the block instances that you need to your model.

You must still restore the block link to its parent library, whether that parent is the SimPowerSystems block library or your own.

Changes to SimPowerSystems Demos

In Version 5.5 (R20011b), demos involving SimPowerSystems plus other Simscape products have been moved to the File Exchange (http://www.mathworks.com/matlabcentral/fileexchange). You can retrieve the demo models by following these links:

Demo Name	File Exchange Location
Fuel Cell Vehicle (FCV) Power Train (`power_FCV_powertrain`)	33309-fuel-cell-vehicle-fcv-power-train

Hybrid Electric Vehicle (HEV) Power Train (`power_HEV_powertrain`)	33310-hybrid-electric-vehicle-hev-power-train-using-battery-model
Electrically-Driven Hydraulic Motor Pump (`power_Hydraulic_Pump`)	33313-electrically-driven-hydraulic-motor-pump
Multi-Level Modeling for Rapid Prototyping of Complex Systems (`power_HEV_MultiFidelity`)	33315-multi-level-modeling-for-rapid-prototyping-of-complex-systems

R2011a

Version: 5.4
New Features: Yes
Bug Fixes: Yes

New Load Flow Tool

The **Load Flow and Machine Initialization** tool that was available in previous releases is renamed **Machine Initialization**. You can use it to set initial conditions of three-phase machines and regulators in order to start simulation in steady-state. The new **Load Flow** tool now provides an improved load flow solution for SimPowerSystems models, with several new features and capabilities:

- The load flow solution uses the Newton-Raphson method. It is more robust and provides a faster convergence than the **Machine Initialization** tool.
- The new **Load Flow** tool comes with a graphical user interface that allows you to display load flow solution at all buses.
- The Three-Phase Source and Three-Phase Programmable Voltage Source blocks are now taken into account in the load flow. You can now specify power and terminal voltage of the Three-Phase Source and Three-Phase Programmable Voltage Source blocks. Similar to the Synchronous Machine, you can declare these voltage sources as PV, PQ, or swing type. Once the load flow is solved, the source internal voltage magnitude and angle are automatically adjusted.
- You can now specify Three-Phase Series and Parallel RLC Load blocks either as constant impedance (constant Z) or as constant power (constant PQ). In the previous tool, the Three-Phase Series and Parallel RLC Load blocks were only considered as constant impedance loads based on the nominal voltage and active and reactive powers specified in the block menu.

The Load Flow Bus block has been added to the Measurements library. The `power_loadflow` function syntax has been modified, and a new **Load Flow** tab has been added to the Powergui block parameters dialog box, as well as to the dialog boxes of all the blocks considered in the load flow solution. For more information on using the new **Load Flow** tool, see Load Flow Tool.

New Asynchronous Machine Block Setup Function

The `power_AsynchronousMachineParams` function lets you compute parameters of a double-cage Asynchronous Machine block based on standard manufacturer specifications. It lets you input manufacturer data and returns the computed machine parameters, along with additional derived data such as synchronous speed, number of pole pairs, nominal slip, starting torque, and so on. The function also lets you display relative errors between the input manufacturer data and the equivalent data obtained with the computed parameters. The function comes with a graphical user interface that allows you to compute the block parameters and apply it to selected block, as well as display the detailed results in the Command window.

5-Phase Synchronous Machine Model Available

The Permanent Magnet Synchronous Machine block has been modified to allow modeling a 5-phase synchronous machine with sinusoidal back EMF and round rotor type. For details, see the block reference page.

SimState Support

SimPowerSystems software now supports Simulink SimState feature, introduced in R2009a. This feature allows you to save all runtime data necessary for restoring the simulation state of a model. For more information, see Saving and Restoring the Simulation State as the SimState in the *Simulink User's Guide*.

New SimPowerSystems Demo

The following demo has been added in Version 5.4:

Demo Name	Description
Flickermeter on a Distribution STATCOM (`power_flickermeter`)	Flickermeter model designed according to functional specifications of the international standard IEC 6100-4-15.

R2010b

Version: 5.3
New Features: Yes
Bug Fixes: Yes

Double Squirrel-Cage Rotor Option Available in Asynchronous Machine Block

The Asynchronous Machine block now lets you simulate a double squirrel-cage rotor. The **Rotor type** parameter in the block dialog box has a new option, `Double squirrel-cage`, in addition to the existing rotor modeling options of `Wound` and `Squirrel-cage`. For more information, see the block reference page.

Enhanced Code Generation Capabilities

Code generation support has been added for:

- Models in Phasor mode
- Models employing Ideal Switch mode (under Continuous)

For more information, see Improving Simulation Performance.

New SimPowerSystems Demos

The following demos have been added in Version 5.3:

Demo Name	Description
Synchronous Buck Converter (`power_switching_power_supply`)	Illustrates an abstracted version of a synchronous buck converter that uses ideal switching to give faster simulation times.
AC3 - Sensorless Field-Oriented Control Induction Motor Drive (`ac3_sensorless`)	Models a sensorless field-oriented control (FOC) induction motor drive with a braking chopper for a 200HP AC motor, using a modified version of the AC3 block.
AC7 - Sensorless Brushless DC Motor Drive During Speed Regulation (`ac7_sensorless`)	Models a sensorless brushless DC motor drive with a braking chopper for a 3HP motor, using a modified version of the AC7 block.
Electrically-Driven Hydraulic Motor Pump (`power_Hydraulic_Pump`)	Models a hydraulic pump driven by an electric motor, using SimPowerSystems and SimHydraulics® blocks. Note: This demo has been moved to the File Exchange in Version 5.5 (R20011b).

R2010a

Version: 5.2.1
New Features: Yes
Bug Fixes: Yes

Permanent Magnet Model Available in DC Machine Block

The DC Machine block now lets you model a permanent magnet DC machine, parameterized either by torque (torque per current constant) or by back-emf (voltage per speed constant). A new parameter, **Field type**, allows you to select between the wound-field and the permanent magnet DC machine. For more information, see the block reference page.

R2009b

Version: 5.2
New Features: Yes
Bug Fixes: Yes

Enhanced `power_cableparam` Function

The `power_cableparam` function, introduced in Version 5.1 (R2009a) as part of the Computation of R L and C Cable Parameters (`power_cable`) demo, is now available as a standalone command-line function with associated graphical user interface. It lets you compute RLC parameters of radial copper cables with single screen, based on conductor and insulator characteristics. For more information, see the `power_cableparam` reference page.

Changes to the Fuel Cell Stack Block

Compatibility Considerations: Yes

The Fuel Cell Stack block has been improved to better represent the cell dynamics. The model parameters and the meaning of some detailed parameters have changed since the last release, as described in the following section.

Compatibility Considerations

The Fuel Cell Stack block parameters have been changed in Version 5.2 (R2009b). If you used the **(No) User-Defined** option for the **Preset model** parameter in previous releases and defined particular detailed parameters for your Fuel Cell Stack block, the software will automatically convert your old block parameters into new values corresponding to the block changes.

The following table compares the old parameter names to the new ones. It also provides details on how the new values are computed:

Old Parameters	New Parameters and Values
Open circuit voltage	Voltage at 0A and 1A [V_0(V), V_1(V)] `= [oldvalue, oldvalue*0.95]`

New SimPowerSystems Demos

The following demos have been added in Version 5.2:

Demo Name	Description
Six-Pulse Cycloconverter (`power_cycloconverter`)	Illustrates a six-pulse cycloconverter driving a static load.
Speed Control of a DC Motor Using BJT H-Bridge (`power_Hbridge`)	Illustrates simulation of an H-bridge used to generate a chopped voltage and control speed of a DC motor, in open loop, in both directions.
Five-Cell Multi-Level Converter (`power_fivecells`)	Illustrates a five-cell multilevel converter driving a static load.
Multi-Level Modeling for Rapid Prototyping of Complex Systems (`power_HEV_MultiFidelity`)	Illustrates how to use different detail level in model simulation. For more information, see Multi-Level Modeling for Rapid Prototyping. Note: This demo has been moved to the File Exchange in Version 5.5 (R20011b).

R2009a

Version: 5.1
New Features: Yes
Bug Fixes: Yes

Powergui Tools Are Also Available as Standalone Command-Line Functions

The graphical user interface analysis tools, available in the Powergui block, are now also implemented as standalone command-line functions. Each of these tools can be activated by entering the appropriate command at the MATLAB prompt. For more information, see the following reference pages: `power_fftscope`, `power_hysteresis`, `power_initstates`, `power_lineparam`, `power_loadflow`, `power_ltiview`, `power_report`, `power_steadystate`, `power_zmeter`.

Enhancements to the Ideal Switching Algorithm

The **Display circuit differential equations** option, available in the Powergui block parameters dialog box, lets you display differential equations of the model in the command window when the simulation starts. This option is visible only if **Enable use of ideal switching devices** is selected. For more information, see Using the Ideal Switching Device Method.

Powergui Block No Longer Added Automatically

Compatibility Considerations: Yes

The Powergui block is no longer automatically added to your model upon simulation. You need to explicitly add it to your model. For more information, see Using the Powergui Block to Simulate SimPowerSystems Models.

Compatibility Considerations

If you have an old model without a Powergui block, which used to run in previous releases because Powergui was added automatically during simulation, you will now get an error trying to simulate it. Add a Powergui block and save the model to avoid the error.

Changes to the Battery Block

Compatibility Considerations: Yes

The Battery block has been improved to accurately represent the battery dynamics during the charge and the discharge processes. The model parameters and the meaning of some detailed parameters have changed since the last release, as described in the following section.

Compatibility Considerations

The Battery block parameters have been changed in Version 5.1 (R2009a). If you used the **(No) User-Defined** option for the **Battery Type** parameter in previous releases and defined particular detailed parameters for your Battery block, the software will automatically convert your old block parameters into new values corresponding to the block changes.

The following table compares the old parameter names to the new ones. It also provides details on how the new values are computed:

Old Parameters	New Parameters and Values
Battery Type, set to `(No) User-Defined`	Battery Type, set by default to `Nickel-Metal-Hybrid`
-	Maximum Capacity (Ah) `= RatedCapacity*1.05`
Full charge voltage (%)	Fully charged voltage (v) `= [oldvalue]/100*NominalVoltage`
Nominal Discharge Current (% of Rated Capacity)	Nominal Discharge Current (A) `= [oldvalue]/100*RatedCapacity`

Old Parameters	New Parameters and Values
Capacity (% of Rated Capacity) @ Nominal Voltage	Capacity (Ah) @ Nominal Voltage = `[oldvalue]/100*RatedCapacity`
Exponential zone Voltage (%) Exponential zone Capacity (% of the Rated Capacity)	Exponential zone Voltage (V) = `[oldvalue]/100*NominalVoltage` Exponential zone Capacity (Ah) = `[oldvalue]/100*RatedCapacity`

New SimPowerSystems Demos

The following demos have been added in Version 5.1:

Demo Name	Description
Computation of R L and C Cable Parameters (`power_cable`)	Illustrates use of the `power_cableparam` demo function to calculate the R,L, and C parameters of two 132kV 2-phase cables with screen cables.
Single-Phase Dynamic Load Block (`power_1phdynamicload`)	Illustrates an example of a single-phase dynamic load block built with Simulink blocks. This is the recommended template for interfacing custom-built Simulink blocks with SimPowerSystems models.
Zener Diode Regulator (`power_zener`)	Presents a model of the zener diode used in a voltage regulator.
Full Wave Rectifier (`power_FullWaveRectifier`)	Illustrates use of the Ideal Switching Device solution method to simulate a full wave rectifier using ideal diodes.
Multilevel Multiphase Space-Vector PWM (`power_svpwm_multiPhasesLevel`)	Illustrates modeling and operation of the Multilevel Multiphase Space-Vector PWM and Two-Level Multiphase Space-Vector PWM blocks. The demo includes a five-level five-phase inverter feeding a passive load.
Synchronous Generator and Full Scale Converter (Type 4) Detailed Model (`power_wind_type_4_det`)	Illustrates simulation of a 10 MW wind farm using a detailed model of a Type 4 wind turbine.
Synchronous Generator and Full Scale Converter (Type 4) Average Model (`power_wind_type_4_avg`)	Illustrates simulation of a 10 MW wind farm using an average model of a Type 4 wind turbine.

R2008b

Version: 5.0
New Features: Yes
Bug Fixes: Yes

New Ideal Switching Algorithm

New Ideal Switching algorithm, available in the Powergui block, enables faster and more accurate simulation of power electronic devices. For more information, see Using the Ideal Switching Device Method.

Changes to the Universal Bridge Block

The Universal Bridge block has two new options for modeling voltage-sourced converters (VSC):

- Switching-function based VSC
- Average-model based VSC

New SimPowerSystems Demos

The following demos have been added in Version 5.0:

Demo Name	Description
Switching an Inductive Circuit Using a Breaker With no Snubber (`power_breaker`)	Illustrates the Ideal Switching device solution method of the Powergui block.
Fuel Cell Vehicle (FCV) Power Train (`power_FCV_powertrain`)	Demonstration of a Fuel Cell Vehicle (FCV) power train using SimPowerSystems and SimDriveline. The FCV power train is of the series type. This FCV is propelled by one electric motor powered by a fuel cell and a battery. Note: This demo has been moved to the File Exchange in Version 5.5 (R20011b).

R2008a

Version: 4.6
New Features: Yes
Bug Fixes: Yes

New Fuel Cell Stack Block

A new block, Fuel Cell Stack, has been added to the Extra Sources sublibrary of the Electric Drives library. It implements a generic model parameterized to represent most popular types of fuel cell stacks fed with hydrogen and air. The 6 kW 45 Vdc Fuel Cell Stack demo (`power_fuel_cell`) shows how to use the Fuel Cell Stack block to model a Proton Exchange Membrane (PEM) Fuel Cell Stack feeding an average value 100Vdc DC/DC converter.

The Battery block from the Electrical Sources library is now included in the Extra Sources sublibrary of the Electric Drives library as well.

Initial Conditions Can Be Specified for the Permanent Magnet Synchronous Machine Block

The following enhancements have been implemented for the Permanent Magnet Synchronous Machine block:

- A new parameter, `Initial conditions`, allows you to specify the initial mechanical speed (rad/s), mechanical angle Θ (degrees) and instantaneous stator current (A).
- A new drop-down list lets you select the machine constant that you wish to specify for block parameterization: the flux linkage, the voltage constant, or the torque constant. Once you select a constant, you can enter its value in the appropriate parameter field, while the other two parameters become inaccessible and are only shown for information.
- The dialog box has been rearranged into three tabs, **Configuration**, **Parameters**, and **Advanced**, to improve usability.

Multiple Discretization Rates within a Model Now Available

Compatibility Considerations: Yes

For certain blocks, you can specify a different sample time than the one specified by the Powergui block. This allows you to discretize different parts of a model at different rates in a fixed time step simulation. For example, if one block needs to run at a smaller time step (*t1*) than the rest of the simulation (*t2*), you can speed up simulation of the whole model by specifying a different time step for this block, as long as *t2* = *n* * *t1* (where *n* is an integer).

The following is a list of blocks that currently can be discretized at a different rate:

- Asyhchronous Machine
- DC Machine
- Permanent Magnet Synchronous Machine
- Simplified Synchronous Machine
- Single Phase Asynchronous Machine
- Stepper Motor
- Switched Reluctance Motor
- Synchronous Machine

Dialog boxes for most of these blocks have also been rearranged into three tabs, **Configuration**, **Parameters**, and **Advanced**, to improve usability.

Compatibility Considerations

The DC Machine block can be discretized now. It is recommended that you use it instead of the Discrete DC Machine block, which will be deprecated in the future.

New SimPowerSystems Demos

The following demos have been added in Version 4.6:

Demo Name	Description
6 kW 45 Vdc Fuel Cell Stack (`power_fuel_cell`)	Demonstration of the Proton Exchange Membrane (PEM) Fuel Cell Stack model feeding an average value 100Vdc DC/DC converter. The nominal Fuel Cell Stack voltage is 45Vdc and the nominal power is 6kW.
Solid-Oxide Fuel Cell Connected to Three-Phase Electrical Power System (`power_SOFC`)	This demo illustrates a model of a solid oxide fuel cell (SOFC). The system consists of a SOFC, which is connected to a three-phase infinite bus through an IGBT inverter.
Mechanical Coupling of Synchronous Generator with Exciter System (`power_SM_exciter`)	In large alternators, the excitation system is provided by a small synchronous machine connected on the same shaft as the main synchronous machine. This demo illustrates interconnecting two machines on the same shaft by use of speed input.
Three-Phase Core-Type Transformer (`power_Transfo3phCoreType`)	This demo illustrates use of the Three-Phase Transformer Inductance Matrix Type block to model a three-phase core-type saturable transformer. It also demonstrates that using three single-phase transformers to simulate a Yg/Yg core-type transformer is not acceptable.
Three-Phase Matrix Converter (`power_three_phase_matrix_converter`)	This demo illustrates a three-phase matrix converter driving a static load. Indirect space-vector modulation allows direct control of input current and output voltage and hence allows the power factor of the source to be controlled. As a result, the demo outputs the unity power factor at the source.
Three-Phase Active Harmonic Filter (`power_active_filter`)	This demo illustrates the use of a shunt active harmonic filter (AHF) to minimize the harmonic content propagated to the source from a nonlinear load.

R2007b

Version: 4.5
New Features: Yes
Bug Fixes: Yes

New Battery Block

A new block, Battery, has been added to the Electrical Sources library. It implements a generic battery that models most popular battery types, such as Nickel-Metal-Hybride, Lead-Acid, Lithium-Ion, and Nickel-Cadmium. User-Defined Battery type allows you to modify detailed parameters to represent any particular discharge characteristics.

The Hybrid Electric Vehicle (HEV) Power Train demo (`power_HEV_powertrain`), which was introduced in Version 4.4 (R2007a) and shows a multi-domain simulation of a HEV power train based on SimPowerSystems and SimDriveline blocks, has been modified to use the Battery block. It is now called Hybrid Electric Vehicle (HEV) Power Train Using Battery Model.

New Stepper Motor Block

A new block, Stepper Motor, has been added to the Machines library. Depending on the motor configuration specified by the Motor type parameter, this block models:

- A two- or four-phase permanent magnet or hybrid stepper motor
- A three-, four-, or five-phase variable reluctance stepper motor

Three New Transformer Blocks

Three new transformer blocks have been added to the Elements library:

- Grounding Transformer implements a transformer that is used to provide a neutral in a three-phase, three-wire system. The transformer consists of three two-winding transformers connected in a zigzag. The nominal voltage of each of the six windings is Vn/3.
- Three-Phase Transformer Inductance Matrix Type (Two Windings) represents inductive coupling between windings located on different phases of a three-limb or a five-limb core. It also allows modeling of a three-phase transformer built with three single-phase units (no coupling between phases). The transformer R L parameters are obtained from no-load excitation tests and short-circuit tests in positive- and zero-sequence. When core type is specified as **Three-limb or five-limb core**, the transformer is modeled by 9 coupled windings; otherwise, it is modeled by 3 sets of 2 coupled windings (Z0=Z1).
- Three-Phase Transformer Inductance Matrix Type (Three Windings) represents coupling between windings located on different phases of a three-limb or a five-limb core. It also allows modeling of a three-phase transformer built with three single-phase units (no coupling between phases). The transformer R L parameters are obtained from no-load excitation tests and short-circuit tests in positive- and zero-sequence. When core type is specified as **Three-limb or five-limb core**, the transformer is modeled by 9 coupled windings; otherwise, it is modeled by 3 sets of 3 coupled windings (Z0=Z1).

New Measurement Option Available for the PI Section Line Block

A new measurement option, `All pi-section voltages and currents`, is available for the PI Section Line block. It allows you to measure voltages and currents at the start and end of each pi-section.

New SimPowerSystems Demos

The following demos have been added in Version 4.5:

Demo Name	Description
Ni-MH Battery Model (`power_battery`)	Demonstration of the battery model during charge and discharge process. The demo models a 200 V, 6.5 Ah Ni-MH battery.
Stepper Motor Drive (`power_steppermotor`)	Demonstration of a hybrid stepper motor drive. The parameters are those of a small stepper motor (size 23).
D-STATCOM (Average Model) (`power_dstatcom_avg`)	In the average model of a Distribution STATCOM, the IGBT Voltage-Sourced Converters (VSC) are represented by equivalent voltage sources generating the AC voltage averaged over one cycle of the switching frequency. This model does not represent harmonics, but the dynamics resulting from the control system and power system interaction are preserved. This model allows using much larger time steps (typically 40-50 microseconds), thus allowing simulations of several seconds.
D-STATCOM (Detailed Model) (`power_dstatcom_pwm`)	The detailed model of a Distribution STATCOM includes detailed representation of power electronic IGBT converters. In order to achieve an acceptable accuracy with the 1680 Hz switching frequency used in this demo, the model must be discretized at a relatively small time step (5 microseconds). This model is well suited for observing harmonics and control system dynamic performance over relatively short periods of times (typically hundreds of milliseconds to one second).
UPFC (Detailed Model) (`power_upfc_gto48p`)	Detailed model of a 48-pulse, GTO-based Unified Power Flow Controller (500 kV, 100 MVA).

Renamed `psbhysteresis` Command

Compatibility Considerations: Yes

In Version 4.5 (R2007b), `power_hysteresis` is the new name for the old `psbhysteresis` command. You use it exactly the same way you would use the `psbhysteresis` command.

Compatibility Considerations

Currently, if you issue the `psbhysteresis` command, it will automatically redirect to its new name, `power_hysteresis`. However, it is recommended that you update your scripts and use the new command name going forward.

R2007a

Version: 4.4
New Features: Yes
Bug Fixes: Yes

New Brushless DC Motor Drive Block

A new block, Brushless DC Motor Drive, has been added to the Electric Drives/AC Drives library. It implements a brushless DC motor drive using a Permanent Magnet Synchronous Motor (PMSM) with trapezoidal back electromotive force (BEMF). It is possible to use a simplified version of the drive containing an average-value model of the inverter for faster simulation. In SimPowerSystems software, the Brushless DC Motor Drive block is commonly called the `AC7` motor drive.

Automated Conversion of Version 2 Models Is No Longer Supported

Compatibility Considerations: Yes

The automated conversion of old models, created with blocks from SimPowerSystems 2.3 or Power System Blockset™ 2 libraries, is no longer supported in Version 4.4 (R2007a).

Compatibility Considerations

The `psbupdate` function is obsolete as of Version 4.4 (R2007a).

New SimPowerSystems Demos

The following demos have been added in Version 4.4:

Demo Name	Description
Hybrid Electric Vehicle (HEV) Power Train (`power_HEV_powertrain`)	Multi-domain simulation of a HEV power train based on SimPowerSystems and SimDriveline blocks. The HEV power train is of the series-parallel type, such as the one found in the Toyota Prius car. This HEV has two kinds of motive power sources, an electric motor and an internal combustion engine (ICE), in order to increase the drive train efficiency and reduce air pollution. It combines the advantages of the electric motor drive (no pollution and high available power at low speed) and the advantages of an internal combustion engine (high dynamic performances and low pollution at high speeds). Note: This demo has been moved to the File Exchange in Version 5.5 (R20011b).
Aircraft Electrical Power Generation and Distribution (`power_aircraft_distribution`)	This circuit illustrates a generic aircraft Electrical Power Generation & Distribution System. The AC power frequency is variable and depends of the engine speed.

R2006b

Version: 4.3
New Features: Yes
Bug Fixes: Yes

Mechanical Input Parameter Lets You Connect SimMechanics or SimDriveline Blocks to Electric Drives by Specifying Motor Speed as Block Input

The AC and DC Electric Drive blocks have a new parameter called **Mechanical input**, which lets you specify either the load torque or the motor speed as block input.

As of V4.3 (R2006b), mechanical input is available for the following blocks:

- Six-Step VSI Induction Motor Drive (AC1)
- Space Vector PWM VSI Induction Motor Drive (AC2)
- Field-Oriented Control Induction Motor Drive (AC3)
- DTC Induction Motor Drive (AC4)
- Self-Controlled Synchronous Motor Drive (AC5)
- PM Synchronous Motor Drive (AC6)
- Two-Quadrant Single-Phase Rectifier DC Drive (DC1)
- Four-Quadrant Single-Phase Rectifier DC Drive (DC2)
- Two-Quadrant Three-Phase Rectifier DC Drive (DC3)
- Four-Quadrant Three-Phase Rectifier DC Drive (DC4)
- One-Quadrant Chopper DC Drive (DC5)
- Two-Quadrant Chopper DC Drive (DC6)
- Four-Quadrant Chopper DC Drive (DC7)

To switch to the motor speed as mechanical input, open the block dialog box and set the **Mechanical input** option in the bottom portion of the dialog box to `Speed w`. Note that if you select the motor speed as mechanical input, the internal mechanical system is not used and the inertia and viscous friction parameters are not displayed. You have to include these parameters in the external mechanical system.

R2006a

Version: 4.2
New Features: Yes
Bug Fixes: Yes

Average Values of electricdrivelib Blocks

Two more AC drives blocks, AC3 and AC5, in the `electricdrivelib` library now have a new parameter that allows you to specify average-value models, as opposed to detailed models, for the converters. This parameter was first introduced for some of the `electricdrivelib` library blocks in V4.1 (R14SP2+).

As of V4.2 (R2006a), average-value models are available for the following blocks:

- Space Vector PWM VSI Induction Motor Drive (AC2)
- Field-Oriented Control Induction Motor Drive (AC3)
- Self-Controlled Synchronous Motor Drive (AC5)
- PM Synchronous Motor Drive (AC6)
- Two-Quadrant Single-Phase Rectifier DC Drive (DC1)
- Four-Quadrant Single-Phase Rectifier DC Drive (DC2)
- Two-Quadrant Three-Phase Rectifier DC Drive (DC3)
- Four-Quadrant Three-Phase Rectifier DC Drive (DC4)
- One-Quadrant Chopper DC Drive (DC5)
- Two-Quadrant Chopper DC Drive (DC6)
- Four-Quadrant Chopper DC Drive (DC7)

To switch to the average-value representation, open the block dialog box and set the **Model detail level** option in the bottom portion of the dialog box to `Average`.

Transformer Blocks with SI Units Are Available

The Transformer blocks now have a parameter named **Units**, which allows you to specify the `SI units` or the `pu units`. In addition, this parameter can be used to automatically convert pu units into SI units, or the reverse.

Open Circuit Option Is Added for the RLC Blocks

The RLC branch blocks how have an extra option under the **Branch Type** parameter that allows you to specify an `Open Circuit` branch. This is particularly useful if you want to temporarily get rid of an RLC element in the circuit without deleting the block.

New Demos and Enhancements to Existing Demos

The following demos have been added.

Demo Name	Description
`power_tcsc_phasor.mdl` `power_tcsc.mdl`	Thyristor Controlled Series Capacitor (TCSC) test systems from Dr. Dragan Jovcic from University of Aberdeen, UK
`power_asm1ph_auxcontrol` `power_asm1ph_vectorcontrol`	The single-phase Asynchronous Machine block using the `Main & auxiliary windings` configuration

In the Wind Farm DFIG demos of the Distributed Resources library, control systems have been enhanced.

R14SP3

Version: 4.1.1
New Features: No
Bug Fixes: Yes

R14SP2+

Version: 4.1
New Features: Yes
Bug Fixes: Yes

New Blocks in the Machines Library of powerlib

The machines library of powerlib contains a model of a Switched Reluctance Motor that allow you to model three typical configurations of such a motor. The library also contains a model of a Single-Phase Asynchronous Machine that can be configured as a split phase, a capacitor-start, or as a capacitor-start-run motor mode.

Enhancements to Existing Blocks of the Machines Library

The core saturation can now be specified for the Asynchronous Machine block when the block is used in a phasor simulation. The saturation model of the Asynchronous Machine is based on the fundamental component of the current and does not include the third harmonic. The saturation parameter is available only when the simulation is in phasor mode. When the Powergui block is set to continuous or discrete mode, the parameter is disabled in the mask of the block.

The Permanent Magnet Synchronous Machine block allows you to specify a trapezoidal flux distribution as an alternative to the sinusoidal flux option of the previous version of the block.

Branch Type Parameter of the RLC Branch Blocks

The Series RLC Branch block, Parallel RLC Branch block, Three-Phase Series RLC Branch block, and Three-Phase Parallel RLC Branch block now have a new parameter that allows you to directly specify the elements that are present in the branch: the R, L, C, RL, LC, RC, and RLC configurations can be specified. It is no longer required to specify an Inf value for the Capacitance in a Series RLC Branch block to get rid of the capacitor device in the branch or to specify 0 value of resistance to get rid of the resistor of a Parallel RLC Branch block.

Average Values of electricdrivelib Blocks

The seven DC drives blocks, and the AC2 and AC6 AC drives of the `electricdrivelib` library now have a new parameter that allows you to specify average value models, as opposed to detailed models, for the converters.

To switch to the average-value representation, open the block dialog box and set the **Model detail level** option in the bottom portion of the dialog box to `Average`.

Obsolete Blocks

Compatibility Considerations: Yes

The Discrete System block and the Machine Measurement Demux block are no longer supported in V4.1 (R14SP2+).

Compatibility Considerations

The table below indicates blocks that are obsolete as of the current version, and lists blocks that you can use as replacement for the obsolete blocks.

Obsolete Block	Removed from Version	Replacement
Discrete System	4.1	Powergui
Machine Measurement Demux	4.1	Bus Selector

R14SP2

Version: 4.0.1
New Features: No
Bug Fixes: Yes