What’s new in SmartCtrl 2.0?
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Find what’s new in SmartCtrl 2.0:

1. New link SMC – PSIM

Now, the power stage, the sensors and initial conditions of inductors and capacitor can be automatically exported to a PSIM schematic. Therefore, the simulation of the complete circuit designed in SmartCtrl can be performed in PSIM without the user having to draw any schematic: Straightforward from SmartCtrl design to Simview.

2. New transfer functions (Audiosusceptibility and output impedance)

For every DC-DC converter and control type, the transfer functions (TF), output voltage to input voltage (Audiosusceptibility) and output voltage to output current (output impedance) are now shown as additional Bode Plots. These TF are very interesting for system converters. E.g. power distribution in satellites, etc.

3. Enhanced PFC design tool

An improved version of the PFC design tool (Power Factor Correction - Boost Converter) has been incorporated to SmartCtrl 2.0. A more practical design of UC3854A controller has been included as well as some other practical information, as the actual values of output voltage when a single pole regulator is used as outer loop compensator.

4. s-domain transfer function for the plant

In SmartCtrl 1.1 the plant can be introduced by the user by means of the predefined topologies or importing the transfer function data by means a text file. Two additional ways are now included in SmartCtrl 2.0.

5. New plant wizard

An equations editor, using a text interpreter (similar to that used in the Simview) will allow users to generate their own models. Now, users will be able to introduce their own formulas and numerical values to generate, save and load their model in text files. Therefore the user can generate its own models library. This is a powerful tool that provides SmartCtrl with total versatility to introduce the power stage transfer functions.

6. New design space for PI controllers

Simple PI controllers are widely used, and many designers use to directly change the gain (K) or the time constant (T) looking for the best dynamic performance of the control loop. A new real-time updated plot that represents a design space in terms of K and T is provided in SmartCtrl 2.0.

7. New global export function

The numerical data of every transfer functions (plant, open loop gain, closed loop gain, etc.) and transient plots can be exported to PSIM, Mathcad, Matlab, Excel, etc. via a txt file.

And take a look at the new SmartCtrl 2.0 Pro:

8. Digital control design tool

A new digital control module is included in the new Pro version. Key features are the following:

- Digital effects (DEFs) such as sampling frequency, DPWM delays, and rounding effects due to the limited bits number of compensator coefficients are considered.
- New Bode plots considering DEFs are shown.
- Sensitivity analysis of DEFs can be performed.
- The designed digital compensator can be exported to PSIM in z-domain format.

Powersim Inc.
www.powersimtech.com
What’s new in SmartCtrl 2.0?

The summary of new features is the following:

1. New link SMC – PSIM

   Now, the power stage, the sensors and initial conditions of inductors and capacitor can be automatically exported to a PSIM schematic. Therefore, the simulation of the complete circuit designed in SmartCtrl can be performed in PSIM without the user having to draw any schematic: straightforward from SmartCtrl design to Simview.

   1.1. After designing the control loop of the DC-DC converter in SmartCtrl it is possible to export the design to a PSIM schematic just by clicking on the PSIM icon.

   1.2. Select the type of regulator: components (C, R ...), s-domain and z-domain coefficients. Click on OK. Now, you have the PSIM schematic circuit on your screen, ready to work on it.
2. New transfer functions (Audiosusceptibility and output impedance)

For every DC-DC converter and control type, the transfer functions (TF), output voltage to input voltage (Audiosusceptibility) and output voltage to output current (output impedance) are now shown as additional Bode Plots. These TF are very interesting for system converters. E.g. power distribution in satellites, etc.

2.1. Click on the icon View additional transfer function toolbar. Then, you can click on the transfer function in order to see the Bode representation. There are many available transfer functions:

- Open loop audiosusceptibility - \( G_{vv} \)
- Open loop output impedance - \( G_{vi} \)
- Open loop input voltage to inductor current transfer function - \( G_{iLvi} \)
- Open loop output current to inductor current transfer function - \( G_{iLio} \)
- Open loop input voltage to diode current transfer function - \( G_{iDvi} \)
- Close loop audiosusceptibility - \( G_{tvv} \)
- Close loop output impedance - \( G_{tvio} \)
- Close loop input voltage - \( G_{tivi} \)
- Close loop output current - \( G_{tii} \)

![Bode plots](image)

\( a) \) Audiosusceptibility \( G_{vv} \)  
\( b) \) Open loop output impedance - \( G_{vi} \)

Figure 3 Bode plots
3. Enhanced PFC design tool

An improved version of the PFC design tool (Power Factor Correction - Boost Converter) has been incorporated to SmartCtrl 2.0. A more practical design of UC3854A controller has been included as well as some other practical information, like the actual values of output voltage when a single pole regulator is used as outer loop compensator.

3.1. At first, select the type of the multiplier and its parameter. Then, design the inner and outer loops using the provided solution maps. The results are depicted in several plots, including the expected waveforms at the output of the inner loop and the outer loop.

3.2. It is possible to export the PFC design to a PSIM schematic just by clicking on the PSIM icon, including the power stage, the UC3854A controller, the components of the inner and outer compensators, the feedback loop and the oscillator.

Figure 4 Selection of the UC3854A multiplier

Figure 5 Useful plots to analyze the converter

Figure 6 PSIM Schematic ready for simulation
4. s-domain transfer function for the plant

In SmartCtrl 1.1 the plant could be introduced by the user by means of the predefined topologies or importing the transfer function data by means a text file. Two additional ways are now included in SmartCtrl 2.0: s-domain transfer function for the plant and plant wizard.

4.1. s-domain transfer function for the plant: the user can introduce the numerical values of the coefficients of the plant transfer function expressed in a polynomial form.
4.2. It is possible to display the Bode plot of the specified transfer function.
4.3. There is a Plant Wizard to assist you while entering the parameters.
5. New plant wizard

An equations editor, using a text interpreter (similar to that used in the Simview) will allow users to generate their own models. Now, users will be able to introduce their own formulas and numerical values to generate, save and load their model in text files. Therefore the user can generate its own models library. This is a powerful tool that provides SmartCtrl with total versatility to introduce the power stage transfer functions.

5.1. The plant wizard assist you to introduce every coefficient of the transfer function \((n_0, n_1, \ldots, n_{10}, d_0, d_1, \ldots, d_{10})\) as a symbolic expression.

5.2. The Editor box helps you to introduce the data with the appropriate format.

5.3. The introduced parameters can be loaded and saved from files with extension .trowfun.

![Figure 9 Wizard to introduce the parameters of the s-domain transfer function as symbolic expressions](image)

![Figure 10 Editor to enter the coefficients](image)
6. New design space for PI controllers

Simple PI controllers are widely used, and many designers use to directly change the gain (K) or the time constant (T) looking for the best dynamic performance of the control loop. A new real-time updated plot that represents a design space in terms of K and T is provided in SmartCtrl 2.0.

6.1. There is a Kp versus Ti Solution Map that allows the tuning of the PI regulator by directly tuning its parameters Kp and Ti.

6.2. The recommended design space corresponds to the white area in between the green and the blue lines. These lines represent the limits of the set of Kp and Ti variables that correspond to feasible PI regulators.

Figure 11 Differences varying the gain and the time constant of a PI controller
7. New global export function

The numerical data of every transfer functions (plant, open loop gain, closed loop gain, etc.) and transient plots can be exported to PSIM, Mathcad, Matlab, Excel, etc. via a txt file.

There are several ways of exporting data in SmartCtrl:

- Schematics to PSIM.
- Transfer functions (plant, compensator, open loop, closed loop, etc.)
- Transient response.
- Input and output data.
- Global.

![Figure 12 Forms or exporting form SmartCtrl](image-url)
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- New Bode plots considering DEFs are shown.
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