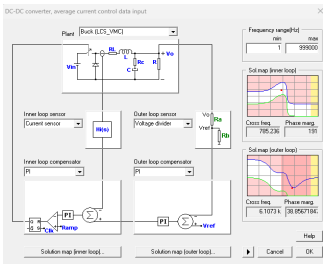
# SmartCtrl

Control Design Software for Power Electronics

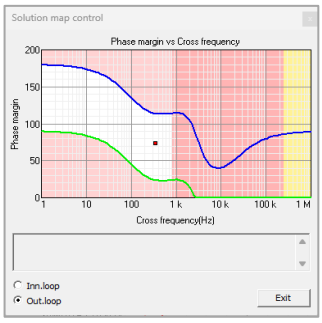
Power Smart Control SL

# Analog and Digital Control Design for Power Electronics

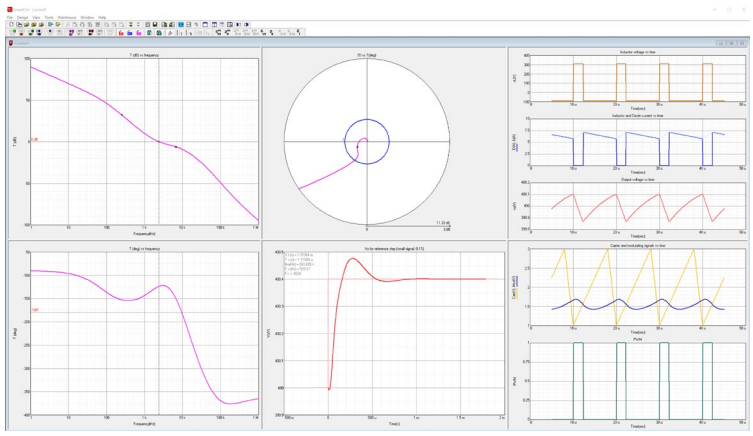
Predefined topologies, imported transfer function and frequency response



Solutions map

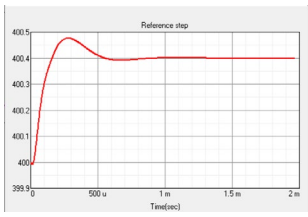



Real time updated plot and design results

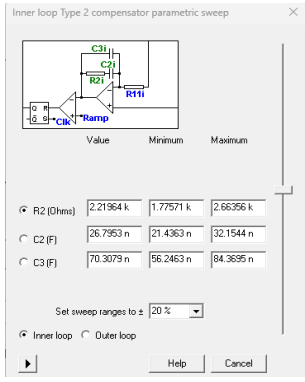


SmartCtrl allows you to easily perform a complete stability analysis of your power converter in order to perform a complete adjustment of the regulators.

Transient response




Sensitivity Analysis




## Simple

- Friendly user interface
- Steady-state waveforms
- Solutions Map for easy controller design
- Interactive plots
- Seamless integration with any simulation software

## Versatile

- DC-DC, DC-AC, AC-AC and AC-DC Converters
- Power Factor Correction Converters
- Equation Editor to define the transfer function
- Different Control Modes

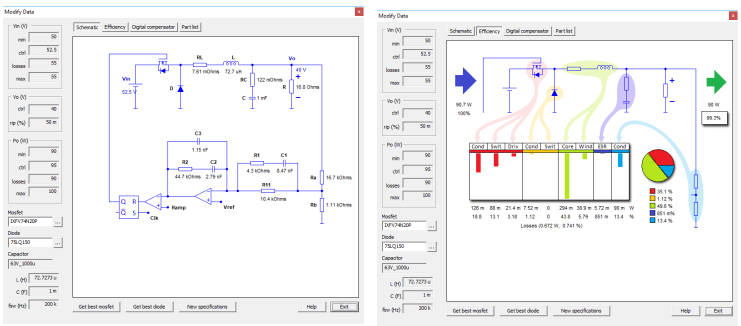
## In-depth knowledge

- Multiloop control structures
- Capability to design digital controllers
- Sensitivity analysis
- Audio-susceptibility

SmartCtrl provides a perfect combination of predefined topologies and compensators, and custom designs with a powerful Equation Editor to create your own transfer functions for all elements of the power converter: plant, sensor and compensator. Import the frequency response of a system and export your control design to any simulation software.

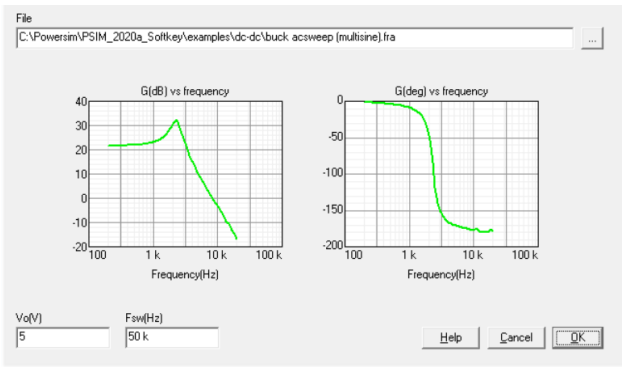
## Control designs from Specifications

Starting from a specification, design quickly and visually the best control for your converter and get the results for an analog or digital control. SmartCtrl includes the complete part list with magnetics design specifications.



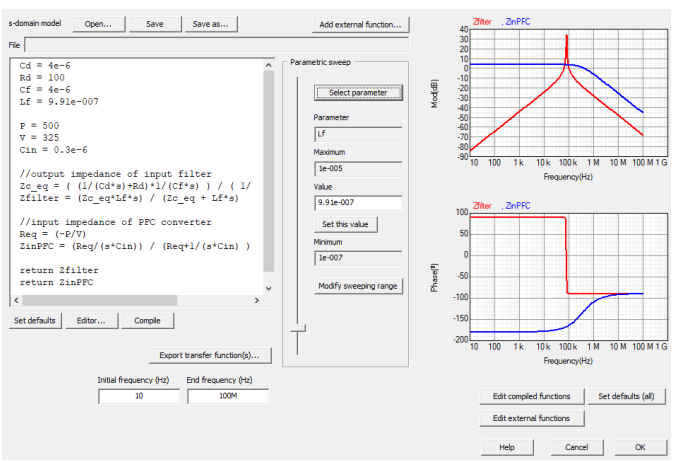
## Import the frequency response

SmartCtrl has a wide set of predefined topologies for control design. It is also possible to import the frequency response of any converter, regardless of its topology.



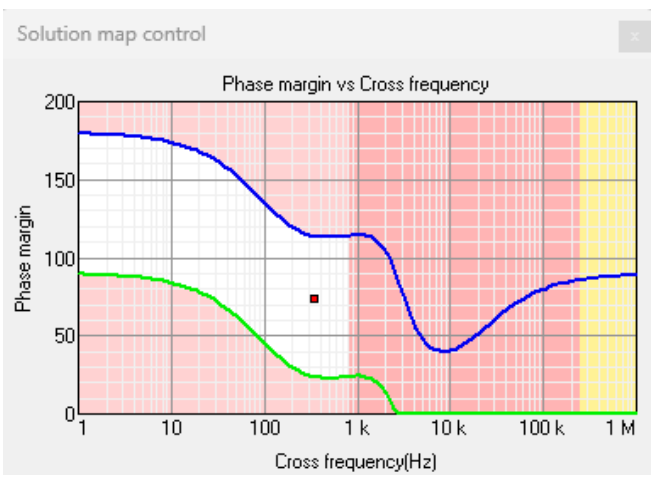

## Make and Edit your own Analytical Model

Using the Equation Editor, it is possible to edit your own analytical model of any specific converter with parameter sweep capability, defining the plant, sensor or compensator.



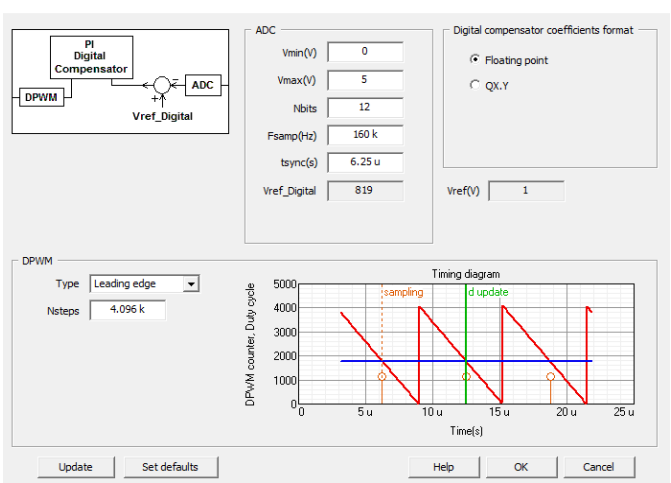

## Solutions Map

Optimize your design using the solutions map. Navigate the cursor within a stable solutions space, which will aid you with the selection of the optimal design.



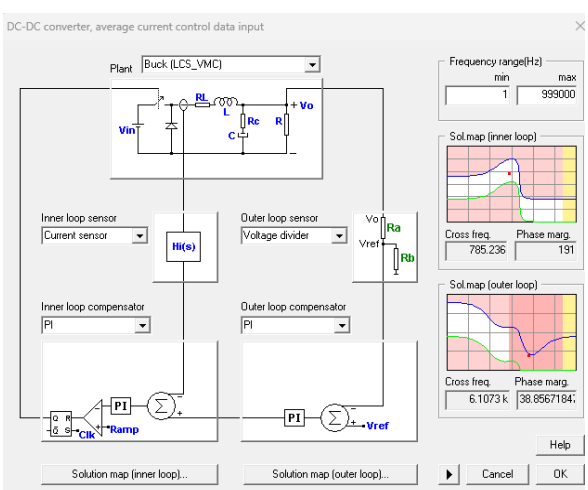

## Analog and Digital Control

Just select the checkbox to define which solution you need: Analog predefined compensators (Type I, II & III PI & PID) or Digital predefined compensators (PI & PID with ADC and SPWM Effects).




## Multi-loop Control Structures

Average-Current Mode Control and Peak-Current Mode Control are supported in SmartCtrl. Analyze how robust is your control.




**Power Smart Control SL**
Avda. Gregorio Peces Barba, 1
28919 Leganes (Madrid), Spain
sales@powersmartcontrol.com

SmartCtrl

Control Design Software for Power Electronics

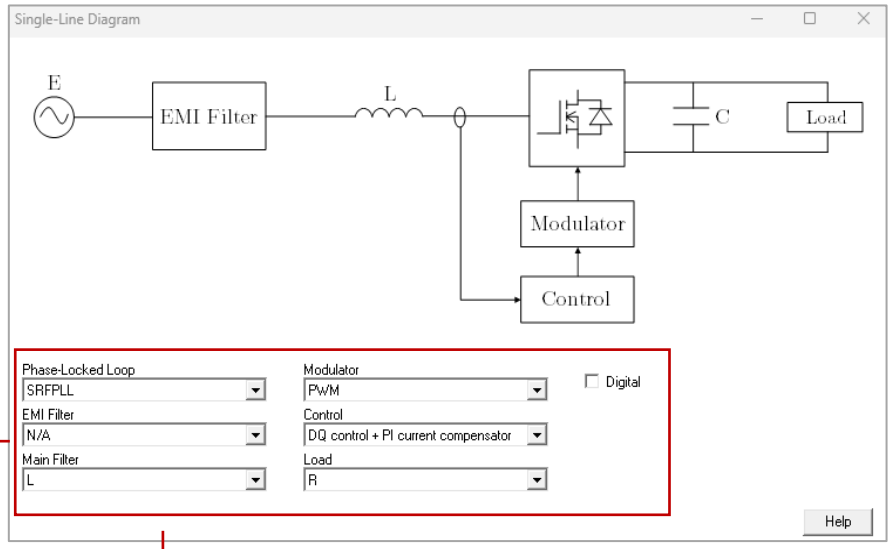
psc Power Smart Control SL

# New AC-DC converter topology: Three-Phase PFC Boost Converter

The Three-phase PFC Boost Converter is a bidirectional two-level rectifier. This three-phase rectifier is frequently used in applications such as electric vehicle (EV) chargers, grid energy storage systems and uninterruptible power supplies (UPS), motor drives and telecommunication power supplies.

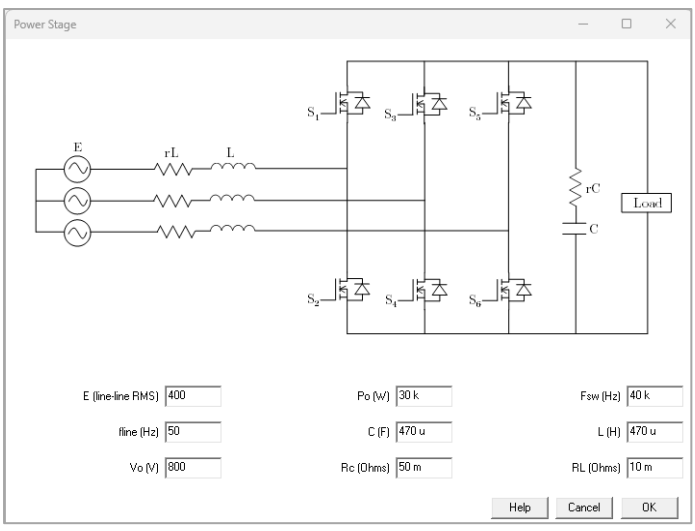
The single line diagram window allows the user to easily configure the type of control structure, phase-locked loop, EMI Filter, modulator, main filter and load.

Just selecting the digital option, the user is able to design control loops in z-domain.

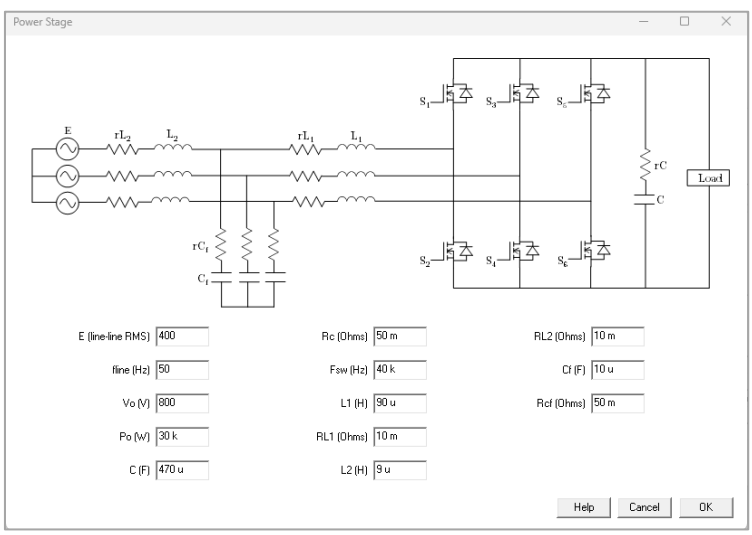



SmartCtrl 2024.1 allows to design the control loops for different types of main filters in a simple way.

L Filter

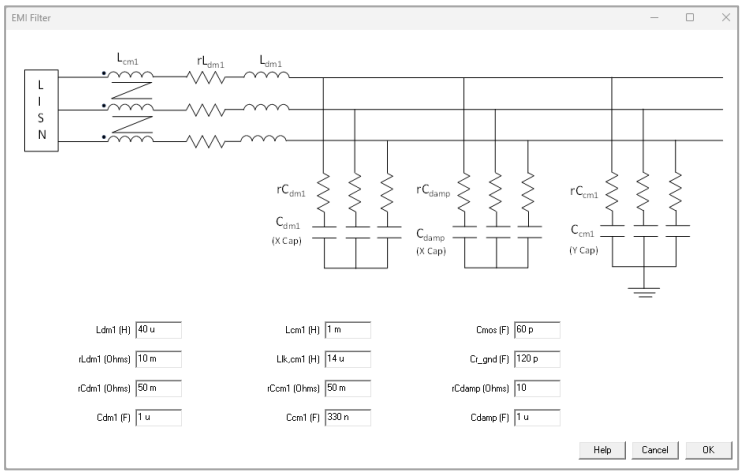


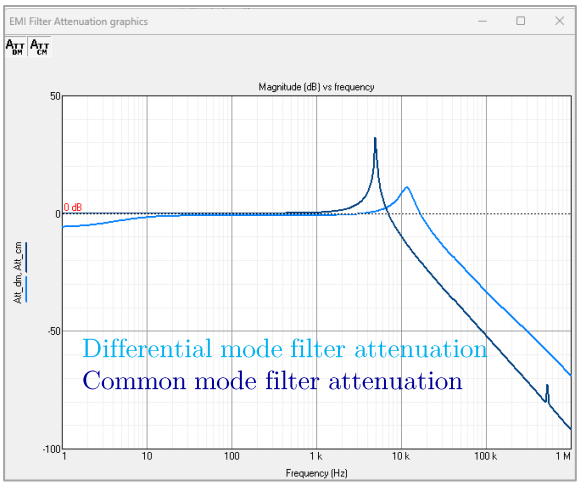

LCL Filter



## EMI Filter

SmartCtrl 2024.1 allows the user to choose among four predefined EMI filter structures. By varying the EMI filter parameters, the attenuation achieved by the common-mode and differential-mode filter can be observed. This tool allows the user to obtain a Preliminary EMI filter design.

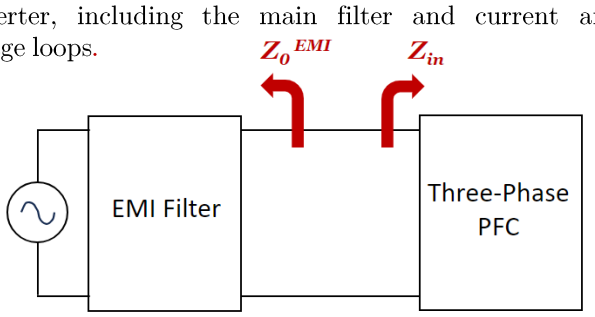


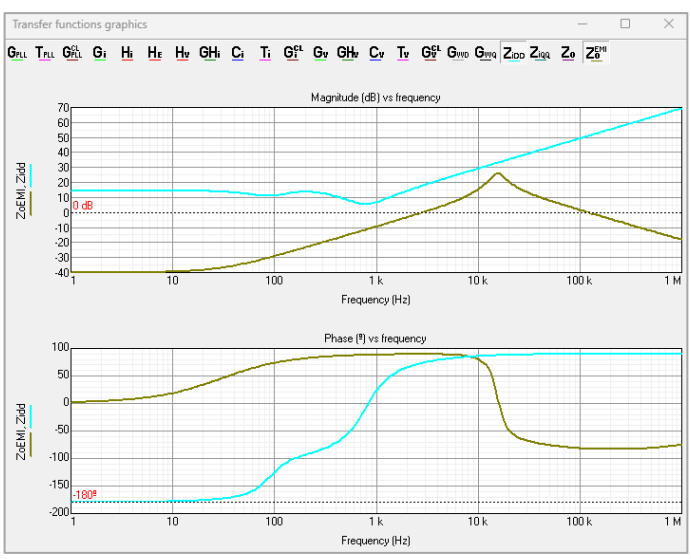

## System Level Stability Analysis

SmartCtrl 2024.1 also allows to predict the system stability when the EMI filter is connected. The system level stability is analyzed using the impedance criterion (Middlebrook & The Gain Margin and Phase Margin Criterion). Two impedances are calculated:

- EMI filter output impedance.
- Input impedances in the dq frame of the controlled converter, including the main filter and current and voltage loops.



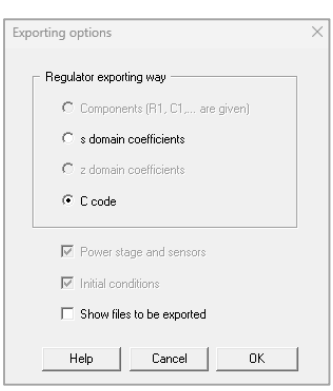

Middlebrook Criterion: $\left\| \frac{Z_o^{EMI}}{Z_i} \right\| \ll 1$

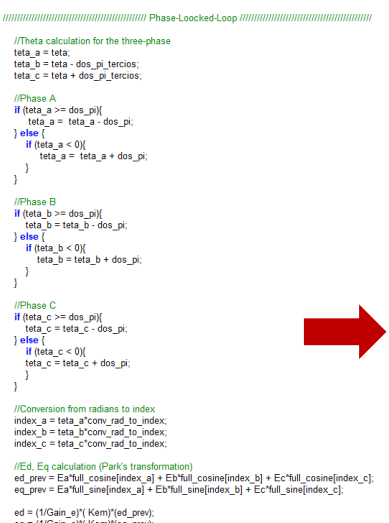


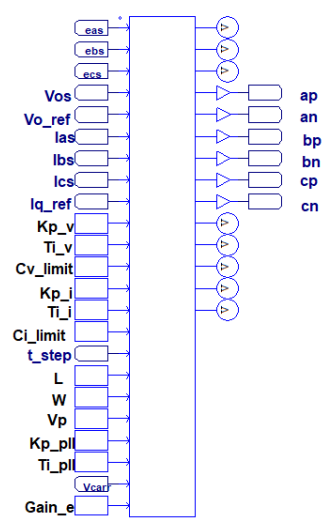

The Gain Margin and Phase Margin Criterion: $\left\| \frac{Z_o}{Z_i} \right\| \le \frac{1}{GM}$ and $\left| \arg(Z_o) - \arg(Z_i) \right| \le 180^\circ - PM$

## Automated C-code generation

Additionally, the control design can now be exported in C code, which allows the user to have a starting template when implementing the control structure in a microcontroller or in a System on Chip SoC.




**Power Smart Control SL**
Avda. Gregorio Peces Barba, 1
28919 Leganes (Madrid), Spain
sales@powersmartcontrol.com