

Power Module

PEEC Technical Example Summary

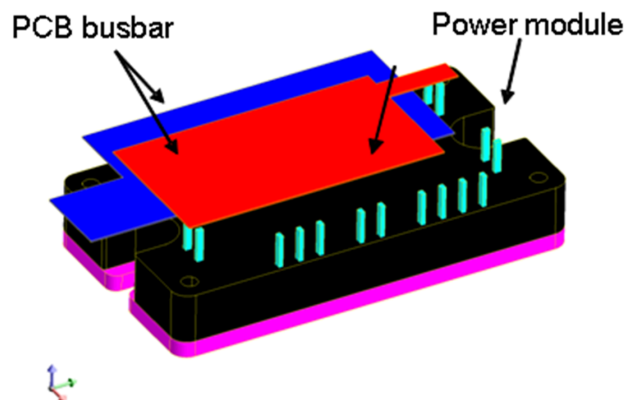
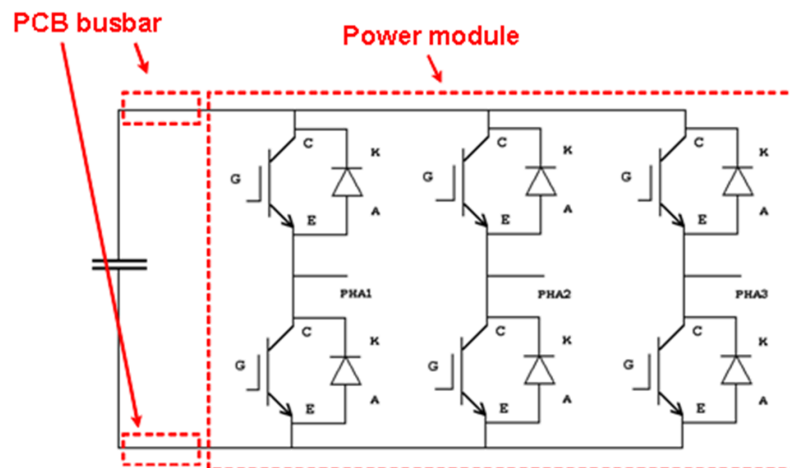
Introduction

This technical example explains all steps to model the interconnection system inside a power electronic module using the Flux PEEC software. It also contains all the data needed to describe the geometry, physics, meshing and analyze obtained computation results.

Studied device

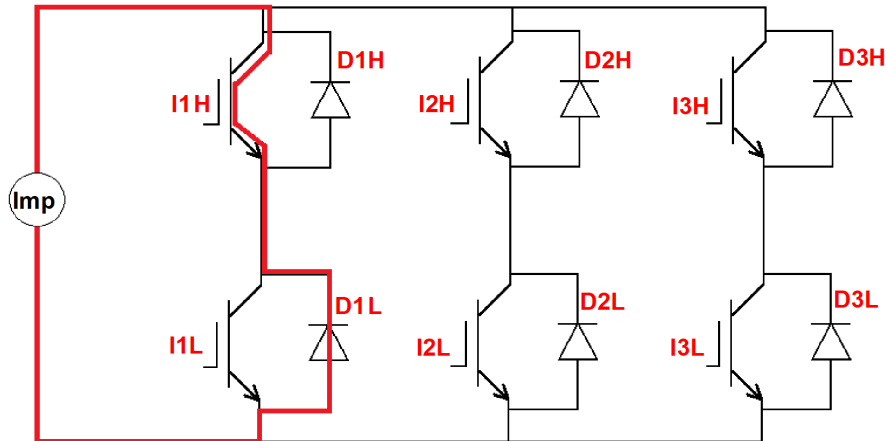
This power electronic module (600 V – 75 Amp nominal current) is a complete three-phase inverter, supplied by a DC line and providing three AC output lines, with six gate pins dedicated to the control. It is designed for AC motor control, and its maximum switching frequency is 20 kHz.

The three-phase inverter uses twelve components (six IGBT and six diodes) to realize six switching functions. An input capacitor is used to minimize the voltage fluctuations.



Example 1: Getting switching loop inductances

The six switching loop inductance values are obtained by using an impedance probe connected to the circuit.



The obtained results for all the six loops (or couples of complementary diode/IGBT) are reported in the table below.

Switching loop results			
Couple IGBT/diode	Equivalent impedance		Loop inductance (nH)
	Real part (Ω)	Imaginary part (Ω)	
I1H-D1L	0.033896	0.311495	49.57
I1L-D1H	0.038755	0.333678	53.10
I2H-D2L	0.041028	0.334755	53.27
I2L-D2H	0.037765	0.336599	53.57
I3H-D3L	0.027215	0.271531	43.21
I3L-D3H	0.036235	0.311266	49.53

Example 2: Adding parasitic capacitances

Analysis of higher-frequency behaviors of the power module needs to include parasitic capacitances in the Flux PEEC model. This second example computes these capacitance matrices and then the equivalent impedance seen from the input of the power module over a large frequency band going up to 200 MHz.

The obtained curve for the first configuration is reported in the figure below. It has to be noted the resonance at the frequency of about 95 MHz, which is caused by the inclusion of the capacitive effects into the resistive-inductive model.

