# Title

Three-phase Power Inverter for academic purposes: lessons learned from teaching electronics.

# Abstract

Teaching power electronics adequately is a complex task.

Within the strategies found in the literature, the one used in this work includes the use of a simulator. (ver possível plágio do paper do Valter)

This simulator represents the hardware platform for a three-legs inverter, with integrated current and voltage measurements.

Currently, the simulator supports an infineon XMC4500 control board, where the same .c code is used either in the simulator and in the control board.

The hardware setup was first used at a Power Electronics course of the Integrated Master Degree in Electrical and Computing Engineering at the Faculty of Engineering of the University of Porto.

The results of this hardware setup usage in this course shows the students learning process, where several fields of power electronics were acquired, such as control loops, input measurements processing, etc.

In this work, the materials and methods to adequately teach either the simulator and the hardware setup will be presented and discussed.

# Introduction

# Literature review

# Materials

Hardware:

* The 3-phase 30A@450V power inverter for academic/research purposes;
* This inverter has built-in measurements of AC currents, AC voltages and DC bus voltage;
* The inverter is based on infineon IPM IKCM30F60GA module (a low-cost module, with integrated drivers);
* The control board is based on XMC4500 Relax (lite) kit, a well known board in UP Laboratory of Power Electronics;

Software:

* PSIM
* .c block
* Libraries

# Methods

## Step 1: practical demonstration of an example implementation

In this step, an example application of one simple capability is presented and is supported with a guide. It is expected that this step will take 2x 2h

This example considers the hardware setup connected to a 30V DC bus, and the three-phase outputs connected to a RL load. The objective of this demonstration example is to generate an AC output voltage in the inverter, that will be seen as an AC current in the RL load.

The simulation example will have all hardware modelling and a .c block with the code ready to generate the output desired waveforms.

## Step 2: theorical presentation of the libraries

In this step, a few libraries will be presented for general purpose implementations. In this set of libraries, PI controllers, first order low pass filters, Park/Clark transformations, delays, etc are presented.

## Step 3: presentation of the possible applications

In this step, each of the possible applications of power electronics converters that can be implemented with this three-leg converter are presented.

Examples:

* three phase induction motor control;
* three phase inverter
* single phase motor control
* single phase inverter
* DC motor control
* 3x regulated step-down voltage sources
* Interleaved DC/DC step down converter
* Step-up converter for PV applications
* Bi-directional battery charger