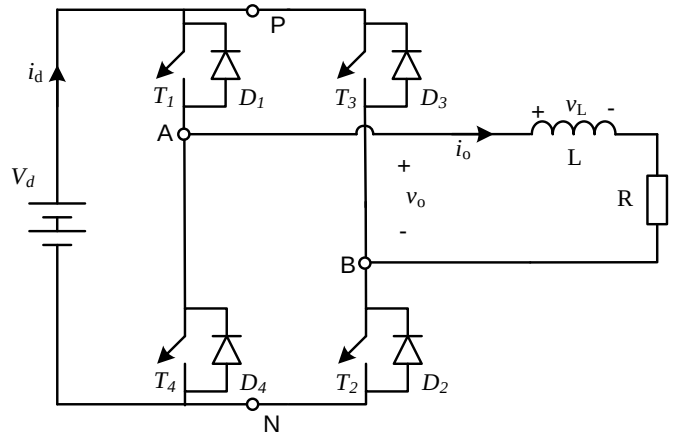
Assignment 4 – Single-Phase Inverter

The questions marked HA are home assignments to be completed before the laboratory starts.



Nominal values for square wave inverter

Source voltage	V_s = 170V
Fundamental frequency	$f_{s(1)}$ = 40Hz

Load inductance	L = 20mH
Load resistance	R = 3Ω

Nominal values for PWM-modulated inverter

Source voltage	V_s = 271V
Fundamental frequency	$f_{s(1)}$ = 40Hz
Switching frequency	f_{sw} = 1000Hz

Load inductance	L = 20mH
Load resistance	R = 3Ω
Modulation index	m_a = 0.8

Source files: *assignment_4.opj*

Tasks/Questions:

HA 1: Plot the load and source current as well as the load voltage for both square-wave operation and PWM modulated operation.

1. Plot the current and voltage waveforms for the *square* wave inverter and the *PWM*-modulated inverter. The schematics are named *Square* and *PWM1*. Can you explain when the diodes will be conducting?

HA 2: Determine the first 5 harmonic components of the load voltage for square-wave operation. What is the fundamental component of the PWM operation? Can you suggest an easy way to calculate the current harmonics if the voltage harmonics are known?

2. Determine the harmonic components for the load current and load voltage as well as the THD for the *square* and *PWM1* converter. Compare the results with the home assignment and describe the main difference in the two converters?
3. For PWM operation mode, analyze the current through diode $D1$ for two different inductive loads: $L = 20mH$ and $L = 40mH$. What is the impact of the inductance on the output current amplitude and ripple? How about on the diode conducting time? (only observation of the waveforms is enough).
4. Open and run the last schematic *PWM2*. What kind of switching scheme is used? Analyze the output voltage and current waveforms and their Fourier components (use the FFT button). What is the advantage and disadvantage of this compared to *PWM1*?