

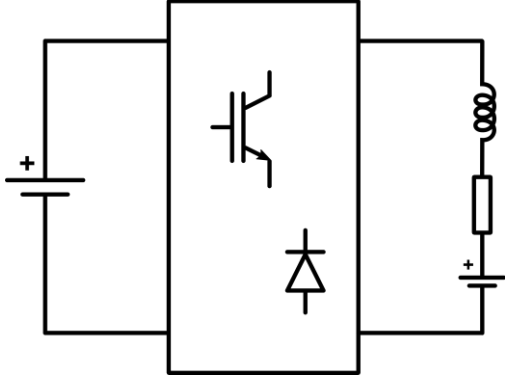
CHOPPERS

n-QUADRANT CHOPPERS

- What are choppers?
- Why do we need them?
- Single-quadrant chopper.
- Two-quadrant choppers.

CHOPPERS

What are choppers?



Types of choppers:

Single-quadrant

Two-quadrant

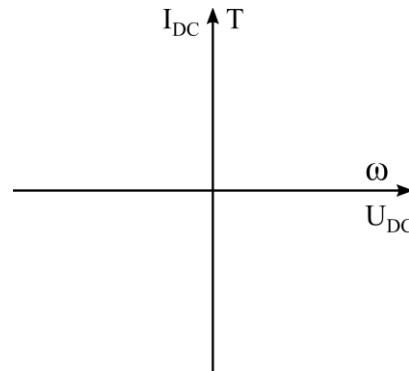
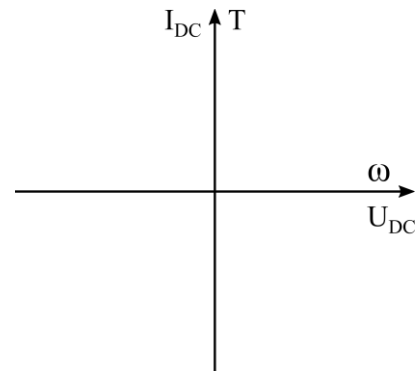
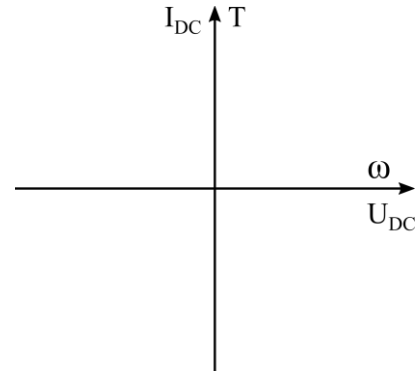
Four-quadrant

There are two types of DC-DC converters:

Those that secure small ΔU_{DC} (output voltage ripple) and those that do not.

The first group are called **dc power supplies** and the second group are called **choppers**.

Examples of DC variables?



CHOPPERS

What is modulation and why do we need it?

Modulation

Modulation is a technique for the generation of excitation commands for the (controllable or semi controllable) semiconductor devices.

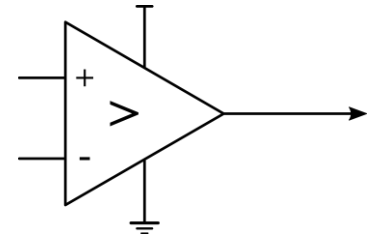
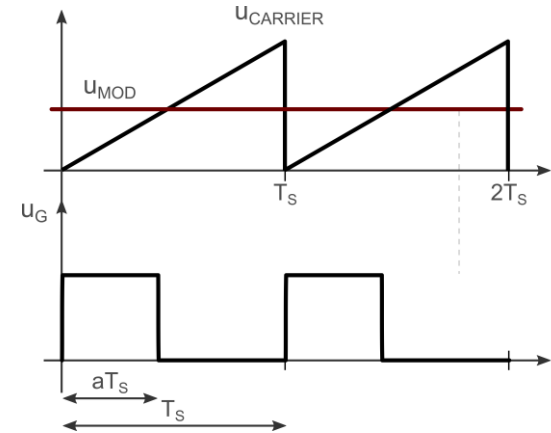
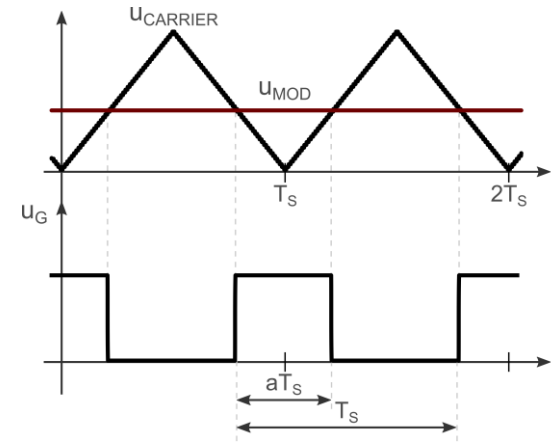
Pulse-width modulation (PWM)

By far the most used type of modulation technique (there are other modulation techniques and there are different PWM techniques).

Carrier and a modulating signal are utilized.

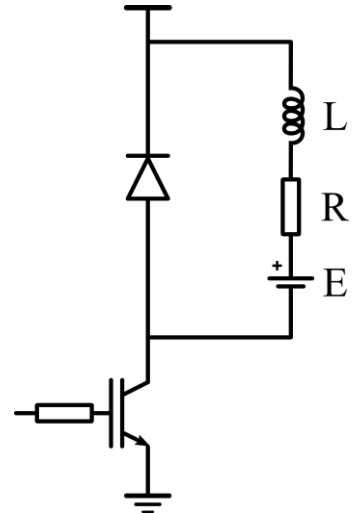
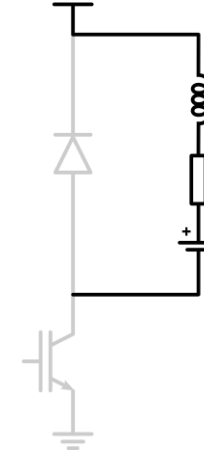
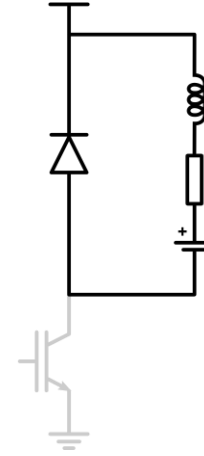
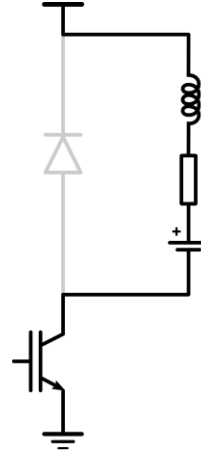
Modulator

Nowadays, modulator is a software unit that generates (internally) carrier signal, compares it with a modulation signal (which is an input to a modulator). A result of that comparison is a excitation signal for semiconductor device(s) (output of the modulator).



CHOPPERS

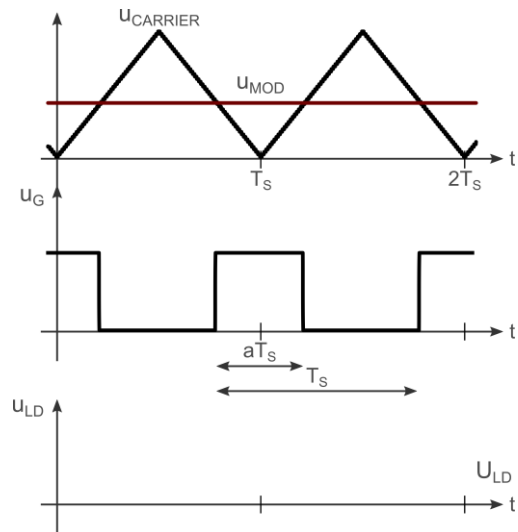
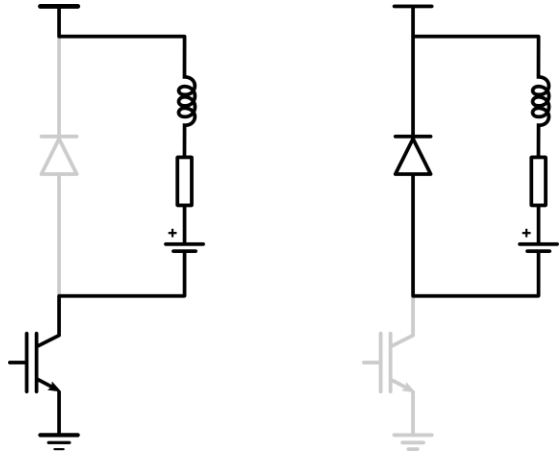
Single-quadrant chopper



CHOPPERS

Single-quadrant chopper

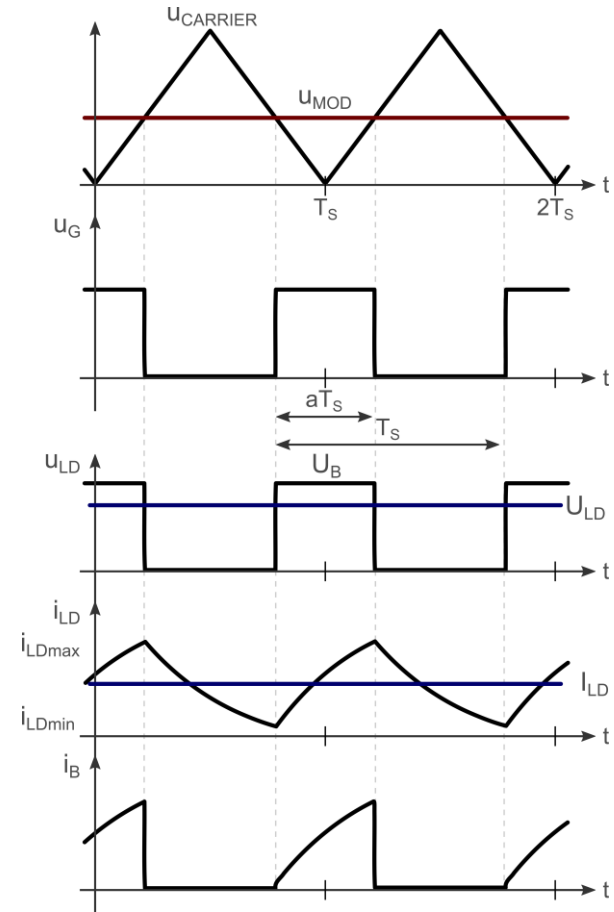
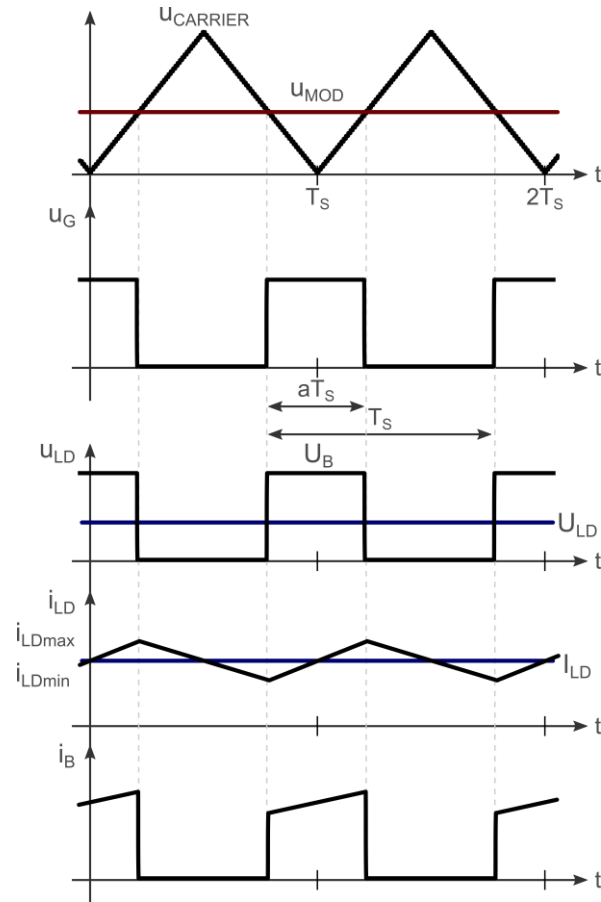
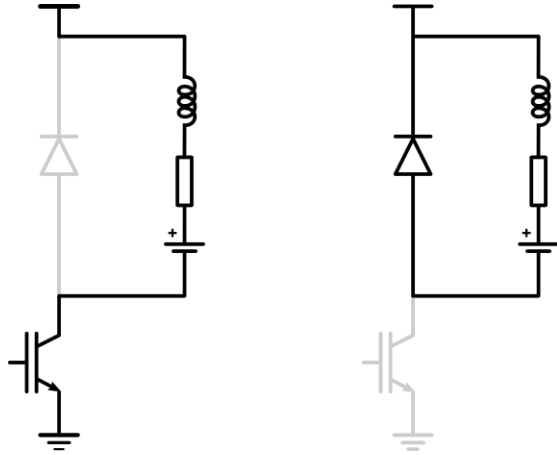
Continuous conduction mode



CHOPPERS

Single-quadrant chopper

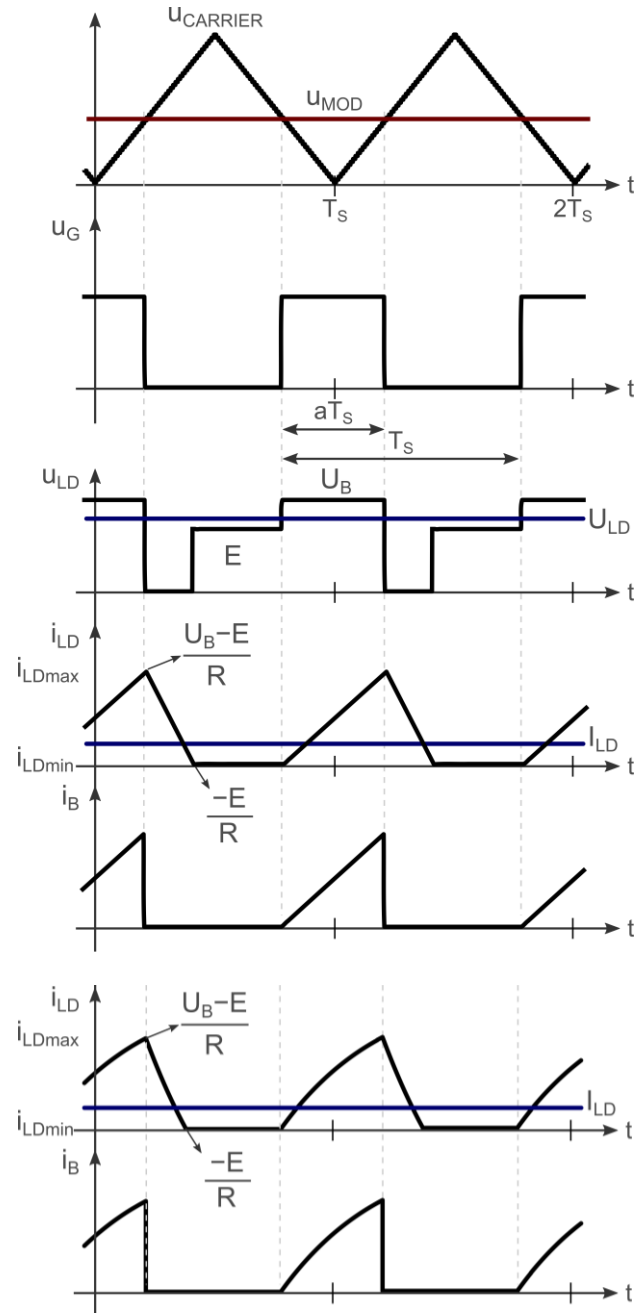
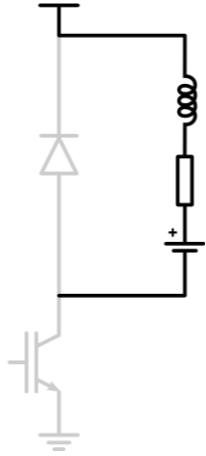
Continuous conduction mode



CHOPPERS

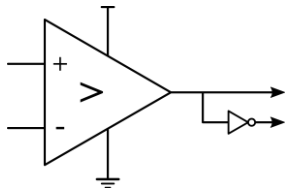
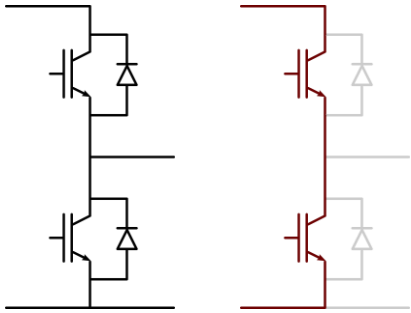
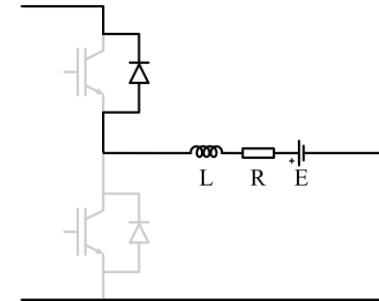
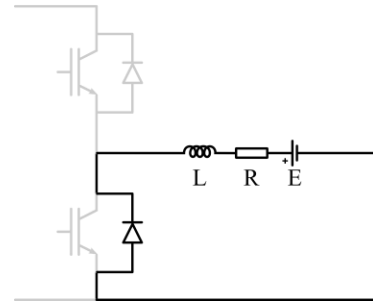
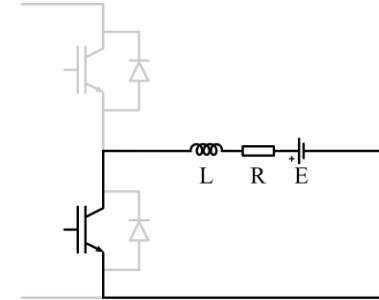
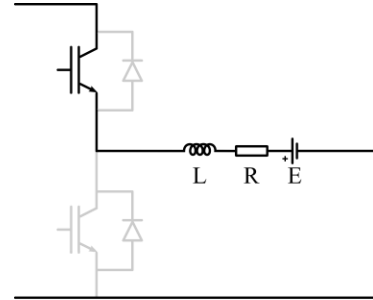
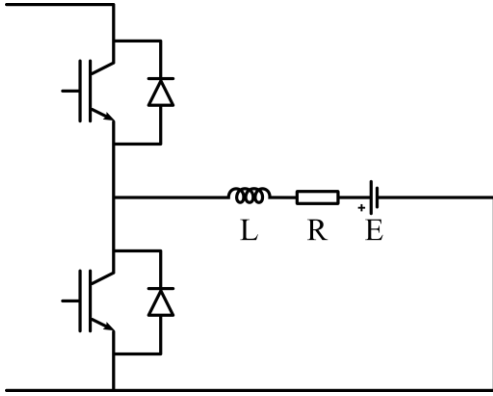
Single-quadrant chopper

Discontinuous conduction mode



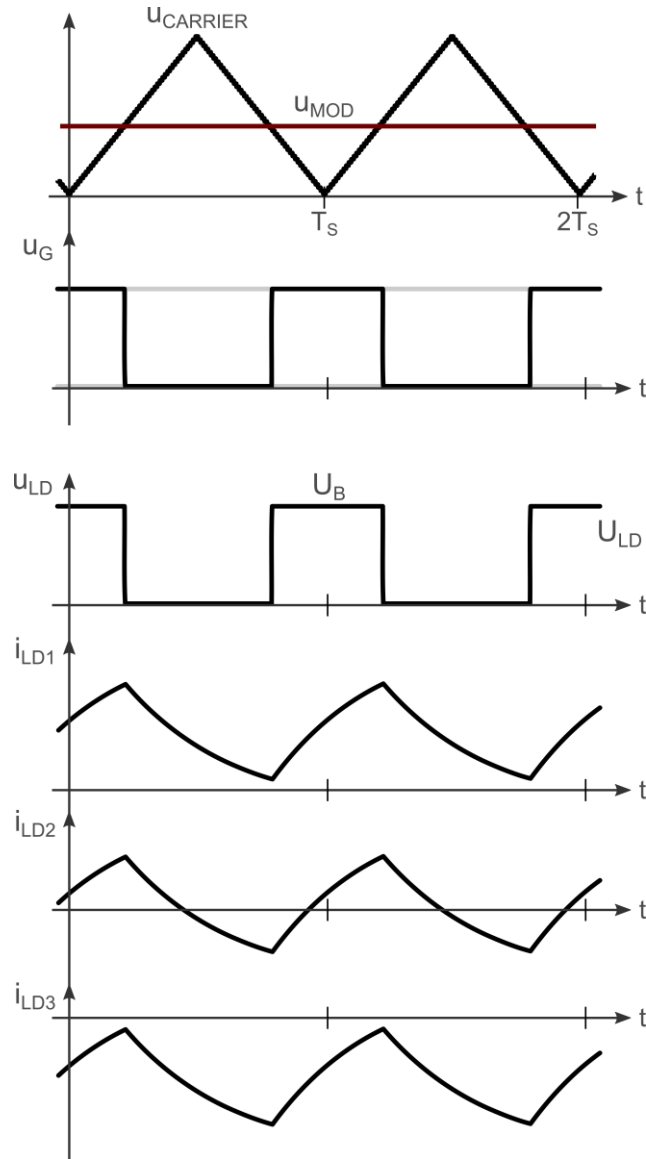
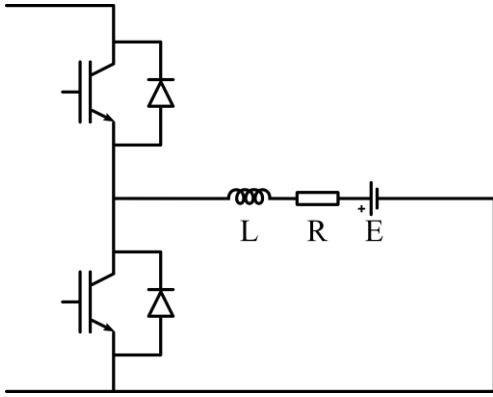
CHOPPERS

Two-quadrant choppers - $U_{LD} \geq 0, i_{LD} \geq 0$



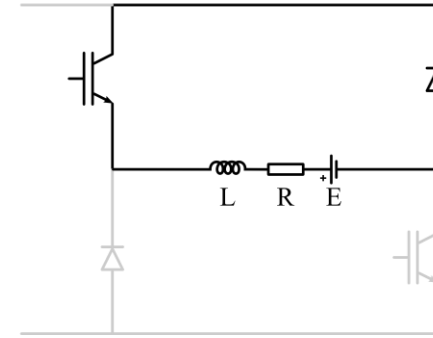
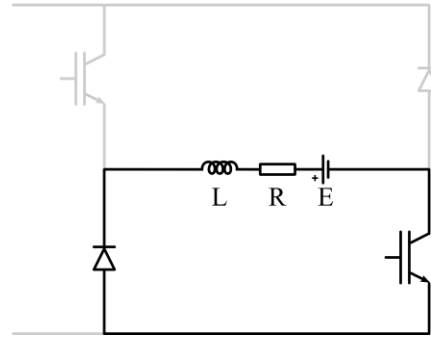
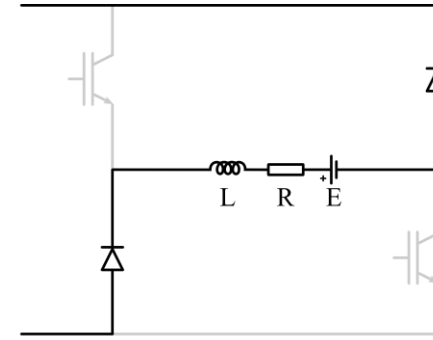
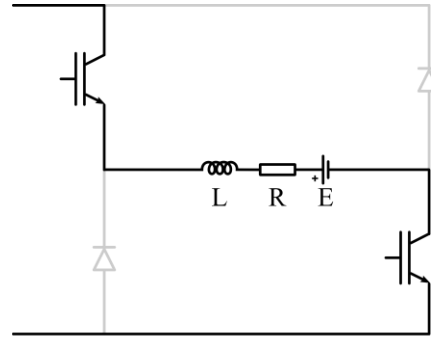
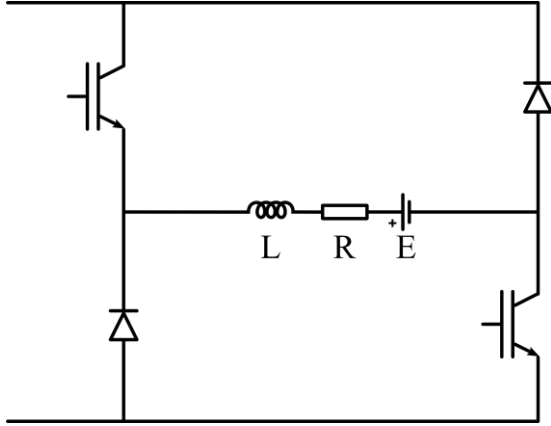
CHOPPERS

Two-quadrant choppers - $U_{LD} \geq 0, i_{LD} \geq 0$



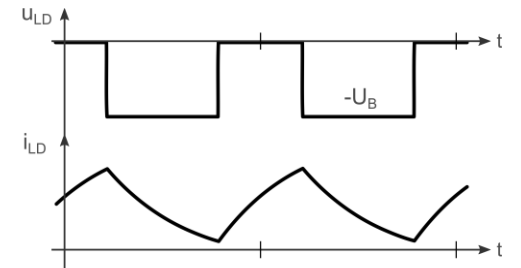
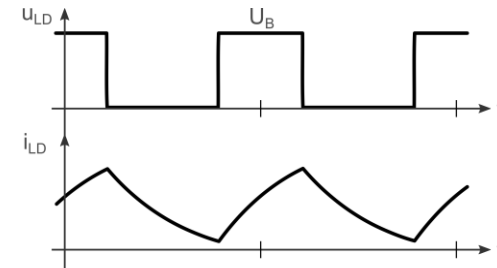
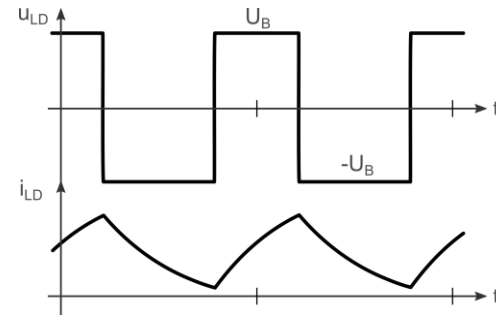
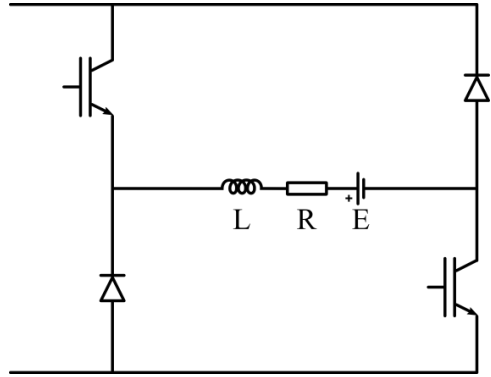
CHOPPERS

Two-quadrant choppers - $U_{LD} \geq 0, i_{LD} \geq 0$



CHOPPERS

Two-quadrant choppers - $U_{LD} \geq 0, i_{LD} \geq 0$



CHOPPERS

n-quadrant choppers - important notes

- (PW)Modulation, modulator, carrier and modulating signals...,
- Duty cycle,
- Choppers are used with inherently inertial loads,
- Continuous and discontinuous conduction modes,
- Operation in different quadrants,
- Maximum, instantaneous and average variables' values.

