

fun.ind Inductors

A pure inductor is defined as an element in which flux linkage λ —the integral of the voltage—across the inductor is a monotonic function \mathcal{F} of the current i ; i.e. the pure constitutive equation is

$$\lambda = \mathcal{F}(i). \tag{1}$$

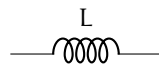


Figure ind.1: inductor circuit diagram symbol.

pure inductor
flux linkage λ

An ideal inductor is such that this monotonic function is linear, with slope called the inductance L ; i.e. the ideal constitutive equation is



ideal inductor

inductance L

The units of inductance are the SI derived unit henry (H). Most inductors have inductance best represented in mH or μ H.

henry (H)

The elemental equation for an inductor is found by taking the time-derivative of the constitutive equation.

Equation 2 inductor elemental equation

Inductors store energy in a magnetic field. It is important to notice how inductors are, in a sense, the opposite of capacitors. A capacitor's current is proportional to the time rate of change of its voltage. An inductor's voltage is proportional to the time rate of change of its current.

Inductors are usually made of wire coiled into a number of turns. The geometry of the coil determines its inductance L .

Often, a core material—such as iron and

core

ferrite—is included by wrapping the wire around the core. This increases the inductance L . Inductors are used extensively in radio-frequency (rf) circuits, with which we won't discuss in this text. However, they play important roles in ac-dc conversion, filtering, and transformers—all of which we will consider extensively.

The circuit diagram for an inductor is shown in [Fig. ind.1](#).