

Input impedance and admittance

We have introduced a generalized version of the familiar impedance and admittance of electrical circuit analysis in which steady-state system behaviour can be expressed algebraically instead of differentially. We begin with generalized input impedance.

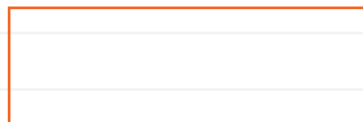
Consider a system with the source shown. The source can be across or through-variable.

The "ideal" source specifies either V_{in} or F_{in} , and the other variable depends on the system.

For the input $V_s(t) = V_{in}(s)e^{st}$, the resulting particular solution for the through variable $F_{in}(s)e^{st}$ is defined by the transfer function $Y(s)$:

We define $Y(s)$ to be the **input admittance**.

Similarly, for input $F_s(t) = F_{in}(s)e^{st}$, the resulting particular solution for the across variable $V_{in}e^{st}$ is defined by the transfer function $Z(s)$:



Impedance of ideal elements

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The impedance and admittance of a single ideal one-port element is defined by its elemental equation.

Generalized capacitors Elemental eq.:
transfer function:

Generalized inductors Elemental eq.: $L \frac{dI_L}{dt} = \psi_L \Rightarrow$
transfer function:

Generalized resistors Elemental eq.:
transfer function: