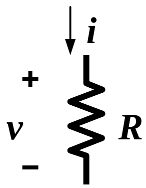
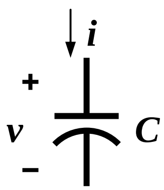
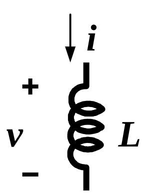
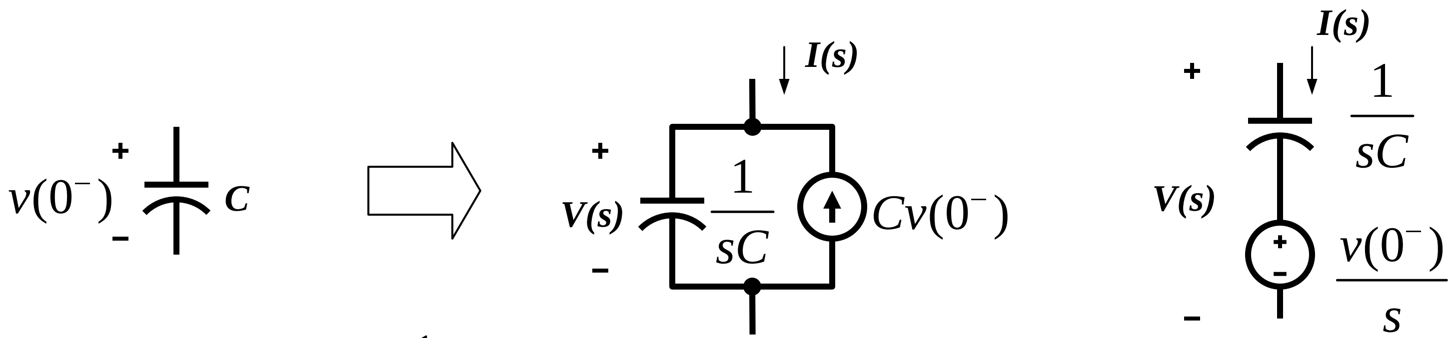
Circuit Elements in the s-domain

	Time Domain	***s*-Domain**
	$v = iR$	$V(s) = I(s)R$
	$i = C\dfrac{dv}{dt}$ $v(t) = \dfrac{1}{C}\displaystyle\int_0^t i\,dt + v(0^-)$	$I(s) = sC\,V(s) - Cv(0^-)$ $V(s) = \dfrac{1}{sC}I(s) + \dfrac{v(0^-)}{s}$
	$v = L\dfrac{di}{dt}$ $i(t) = \dfrac{1}{L}\displaystyle\int_0^t v\,dt + i(0^-)$	$V(s) = sL\,I(s) - Li(0^-)$ $I(s) = \dfrac{1}{sL}V(s) + \dfrac{i(0^-)}{s}$

Note how initial conditions are incorporated

Equivalent Circuits

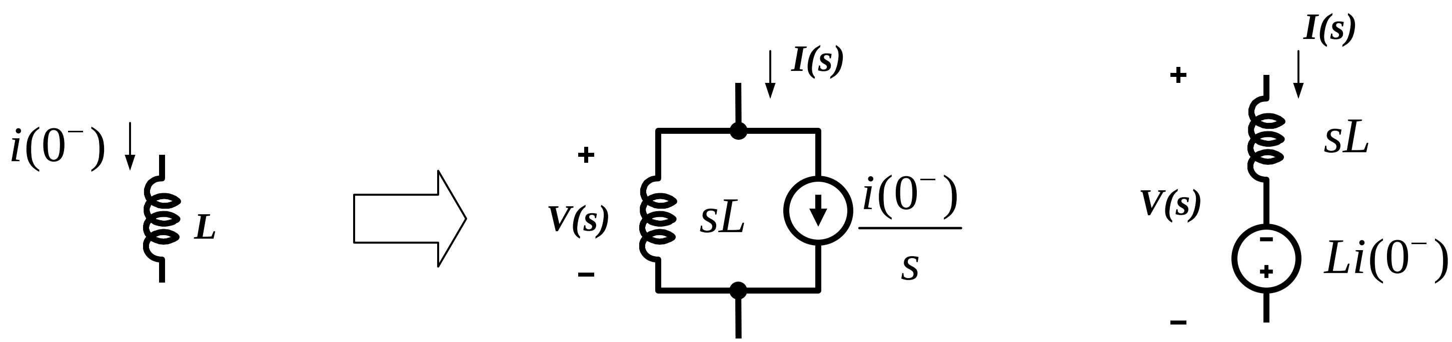
Using the results of the previous slide we can draw equivalent *s*-domain circuits for capacitors and inductors to account for initial conditions:



Capacitor has an impedance: $\frac{1}{sC}$

$$I(s) = sCV(s) - Cv(0^-)$$

$$V(s) = \frac{1}{sC} I(s) + \frac{v(0^-)}{s}$$



Inductor has an impedance: sL

$$I(s) = \frac{1}{sL} V(s) + \frac{i(0^-)}{s}$$

$$V(s) = sL\, I(s) - Li(0^-)$$

Note polarity of sources representing initial conditions