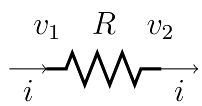
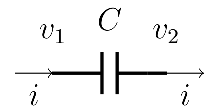
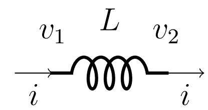
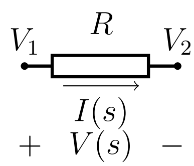
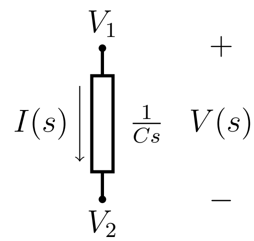
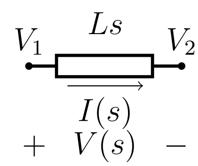
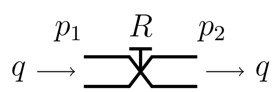
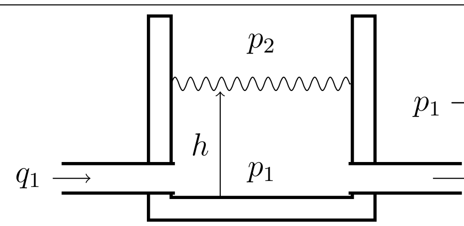
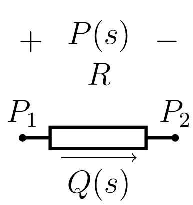
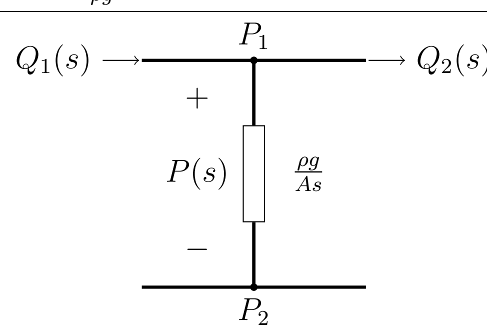
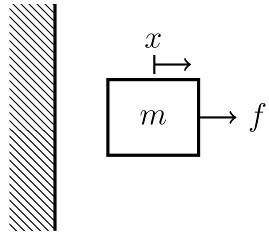
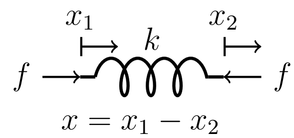
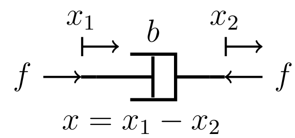
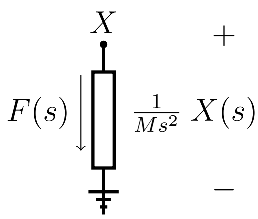
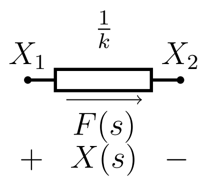
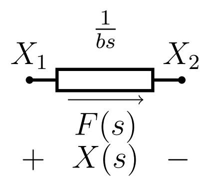
Electrical Impedance

	resistor	capacitor	inductor
Component			
Component law	$v_1 - v_2 = iR$	$i = C\frac{d(v_1 - v_2)}{dt}$	$v_1 - v_2 = L\frac{di}{dt}$
Laplace Transform	$V(s) = I(s)R$	$V(s) = \frac{1}{Cs}I(s)$	$V(s) = LsI(s)$
Impedance Component			

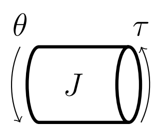
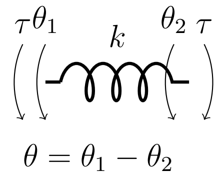
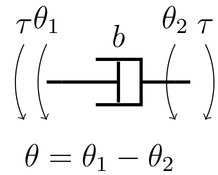
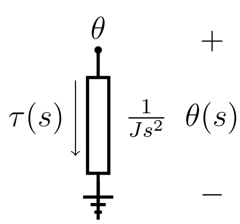
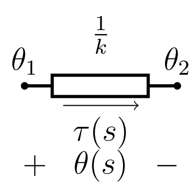
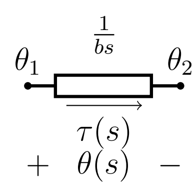
Fluid Impedance

	valve	tank
Component	$p = p_1 - p_2$ 	 $p_1 - p_2 = \rho g h$ Tank Area: A $A\frac{dh}{dt} = q_1 - q_2$ $\frac{A}{\rho g}\frac{d(p_1 - p_2)}{dt} = q_1 - q_2$
Component law	$p = Rq$	$\frac{A}{\rho g}\frac{dp}{dt} = q_1 - q_2$
Laplace Transform	$P(s) = RQ(s)$	$\frac{A}{\rho g}sP(s) = Q_1(s) - Q_2(s)$
Impedance Component		

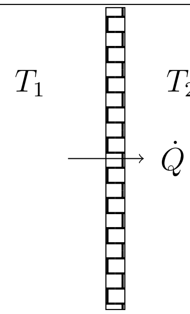
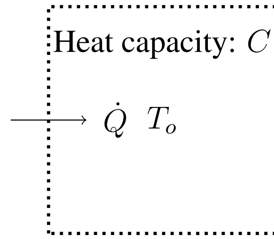
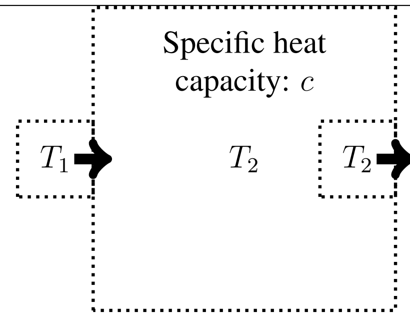
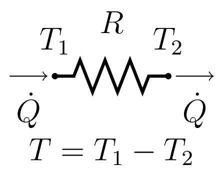
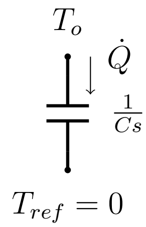
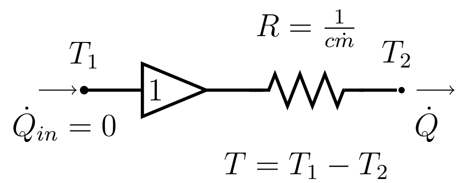
Mechanical Impedance

	mass	spring	damper
Component			
Component law	$f = m\ddot{x}$	$f = kx$	$f = b\dot{x}$
Laplace Transform	$X(s) = \frac{1}{ms^2}F(s)$	$X(s) = \frac{1}{k}F(s)$	$X(s) = \frac{1}{bs}F(s)$
Impedance Component (positive f direction agrees with positive x direction)			

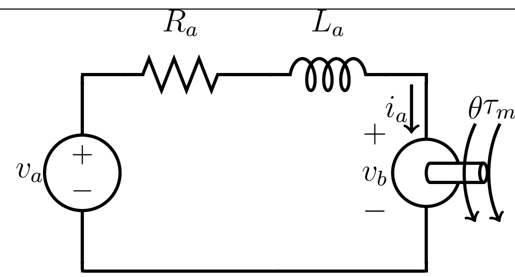
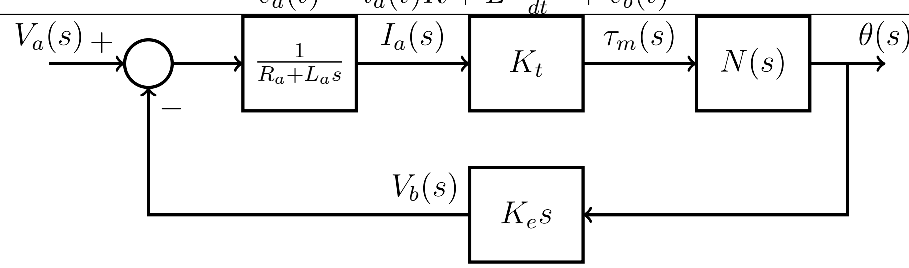
Rotational Impedance

	mass	spring	damper
Component			
Component Law	$\tau = J\ddot{\theta}$	$\tau = k\theta$	$\tau = b\dot{\theta}$
Laplace Transform	$\theta(s) = \frac{1}{Js^2}\tau(s)$	$\theta(s) = \frac{1}{k}\tau(s)$	$\theta(s) = \frac{1}{bs}\tau(s)$
Impedance Component			

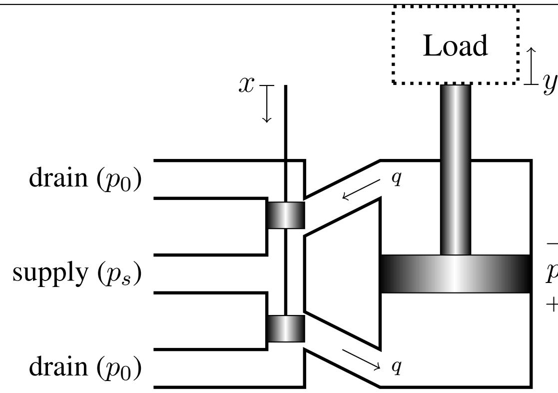
Thermal Impedance

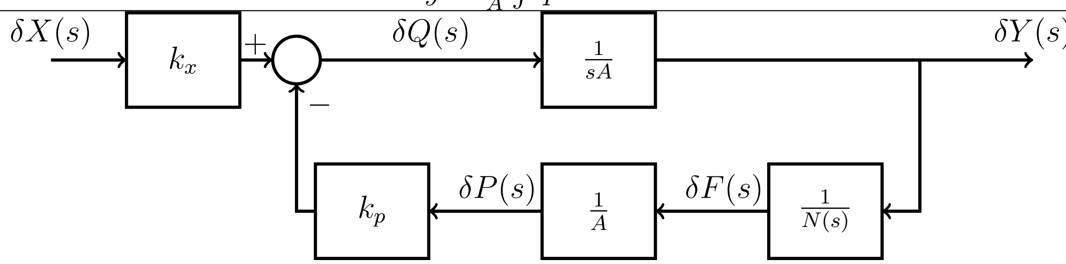
	Resistance	Capacitance	Convection
Component			
Component law	$T = \dot{Q}R$	$\dot{Q} = C\frac{dT_o}{dt}$	$\dot{Q} = \dot{m}cT$
Laplace Transform	$T(s) = \dot{Q}(s)R$	$\dot{Q}(s) = CsT_o(s)$	$\dot{Q}(s) = \dot{m}cT(s)$
Impedance Component			

DC Motor

	DC motor
Component	
Component Law	$v_b = K_e\dot{\theta}$ $\tau_m = K_t i_a$ $v_a(t) = i_a(t)R + L\frac{di_a(t)}{dt} + v_b(t)$
Block Diagram	

Hydraulic

<table>
<tr><th></th><th>Hydraulic</th></tr>
<tr><td>Component</td><td>

Piston area: A</td></tr>
<tr><td>Component Law</td><td>$\delta q = k_x \delta x - k_p \delta p$
$f = pA$
$y = \frac{1}{A} \int q dt$</td></tr>
<tr><td>Block Diagram</td><td>
</td></tr>
</table>