Table 4.1 Second-order system modeling analogies

Generic quantity	**Mechanical translation**	**Mechanical rotation**	**Electrical**	**Hydraulic**
Effort (E)	Force (F)	Torque (T)	Voltage (V)	Pressure (P)
Flow (F)	Speed (v)	Angular speed (ω)	Current (i)	Volumetric flow rate (Q)
Displacement (q)	Displacement (x)	Angular displacement (θ)	Charge (q)	Volume ($\forall$)
Momentum (p)	Linear momentum ($p = mv$)	Angular momentum ($h = J\omega$)	Flux linkage ($I = N\Phi = L\,i$)	Momentum/area ($\Gamma = IQ$)
Resistor (R)	Damper (b)	Rotary damper (B)	Resistor (R)	Resistor (R)
Capacitor (C)	Spring ($1/k$)	Torsion spring ($1/k$)	Capacitor (C)	Tank (C)
Inertia (I)	Mass (m)	Moment of inertia (J)	Inductor (L)	Inertance (I)
Inertia energy storage (special case)	$F = \dot{p}$ ($F = ma$)	$T = \dot{h}$ ($T = J\alpha$)	$V = \dot{\lambda}$ ($V = L\,\mathrm{d}i/\mathrm{d}t$)	$P = \Gamma$ ($P = I\,\mathrm{d}Q/\mathrm{d}t$)
Capacitor energy storage	$F = kx$	$T = k\theta$	$V = (1/C)q$	$P = (1/C)\forall$
Dissipative	$F = bv$	$T = B\omega$	$V = Ri$	$P = RQ$