Table 1

Some Linear Constitutive Relations

System	Constitutive Relation for		
	Energy-Storage Elements		Energy Dissipating Elements
Type	***A*-Type (across) Element**	***T*-Type (through) Element**	***D*-Type (dissipative) Element**
Translatory-mechanical v = velocity f = force	Mass $m\frac{dv}{dt} = f$ (Newton's second law) m = mass	Spring $\frac{df}{dt} = kv$ (Hooke's law) k = stiffness	Viscous damper $f = bv$ b = damping constant
Electrical v = voltage i = current	Capacitor $C\frac{dv}{dt} = i$ C = capacitance	Inductor $L\frac{di}{dt} = v$ L = inductance	Resistor $Ri = v$ R = resistance
Thermal T = temperature difference Q = heat transfer rate	Thermal capacitor $C_t\frac{dT}{dt} = Q$ C_t = thermal capacitance	None	Thermal resistor $R_t Q = T$ R_t = thermal resistance
Fluid P = pressure difference Q = volume flow rate	Fluid capacitor $C_f\frac{dP}{dt} = Q$ C_f = fluid capacitance	Fluid inertor $I_f\frac{dQ}{dt} = P$ I_f = inertance	Fluid resistor $R_f Q = P$ R_f = fluid resistance

Table 2

Force-current Analogy

System Type	Mechanical	Electrical
System-response variables:		
Through-variables	Force f	Current i
Across-variables	Velocity v	Voltage v
System parameters	m	C
	k	$1/L$
	b	$1/R$