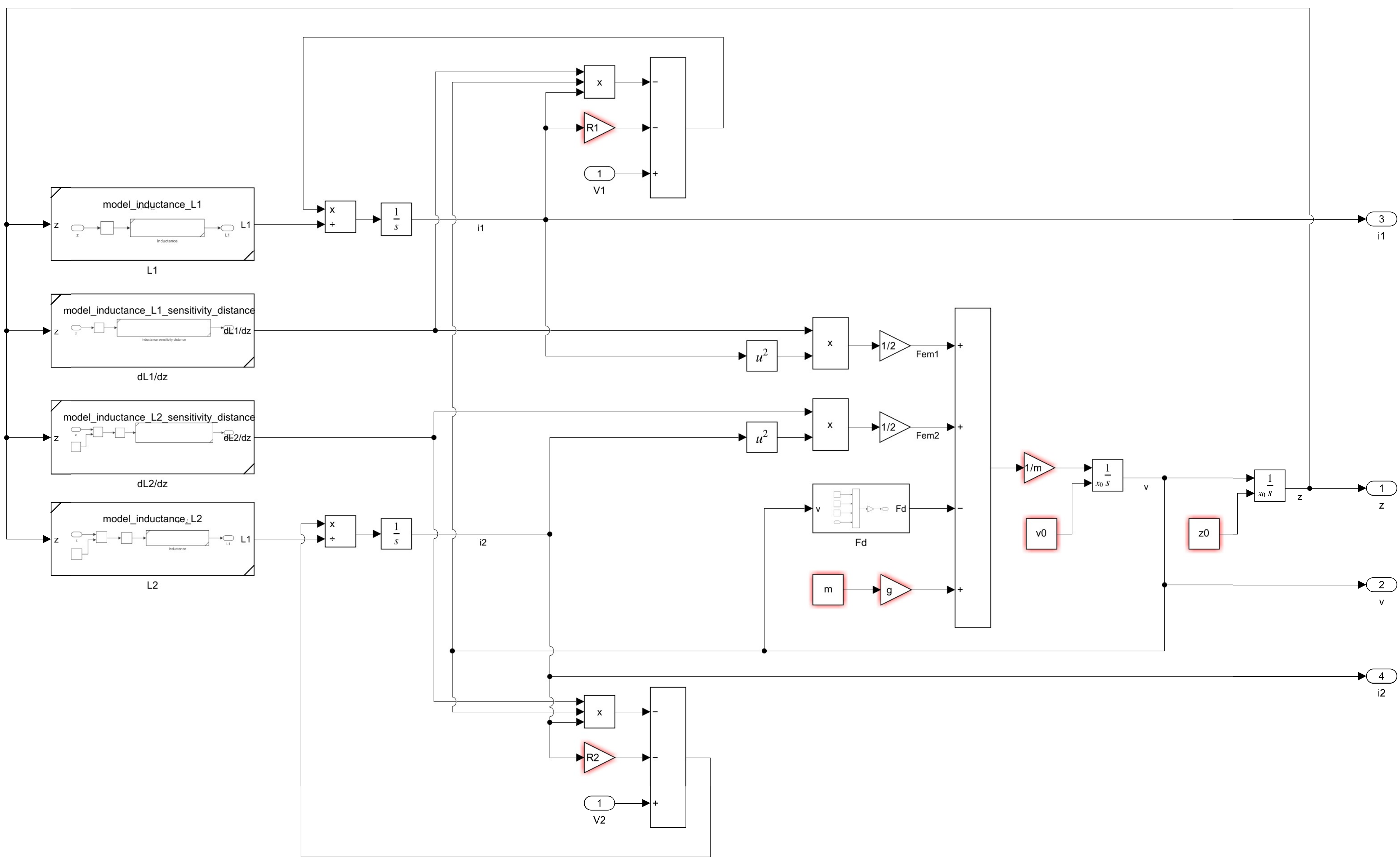
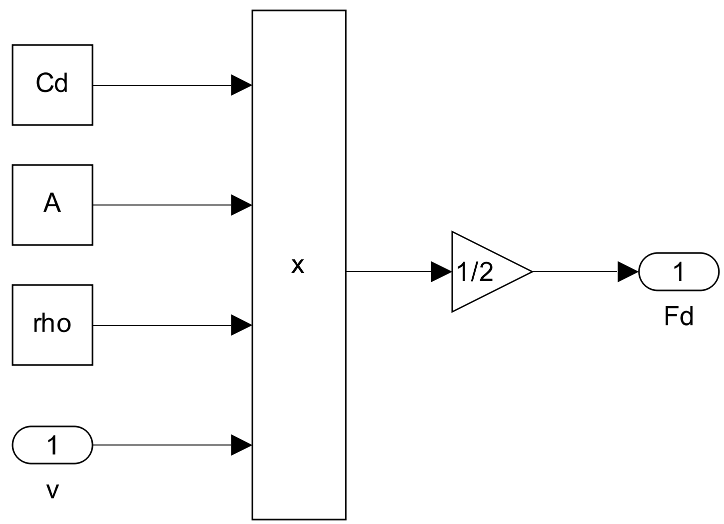
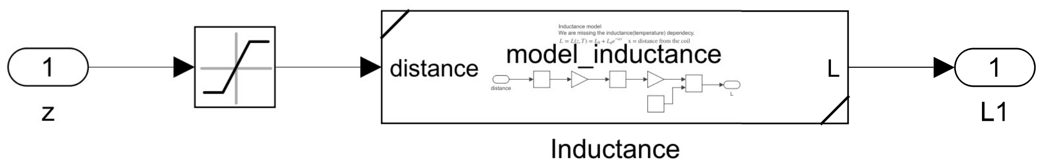
$$
\begin{aligned}
\dot{z} &= v \\
\dot{v} &= \frac{1}{m}\left(\frac{1}{2}\frac{\partial L_1}{\partial z} I_1^2 + \frac{1}{2}\frac{\partial L_2}{\partial z} I_2^2 - F_d + mg\right) \\
\dot{I_1} &= \frac{1}{L_1}\left(-\frac{\partial L_1}{\partial z}\dot{z} I_1 - \frac{\partial L_1}{\partial T_1}\dot{T}_1 I_1 - R_1 I_1 + V_1\right) = 0 \\
\dot{I_2} &= \frac{1}{L_2}\left(-\frac{\partial L_2}{\partial z}\dot{z} I_2 - \frac{\partial L_2}{\partial T_2}\dot{T}_2 I_2 - R_2 I_2 + V_2\right) = 0
\end{aligned}
$$

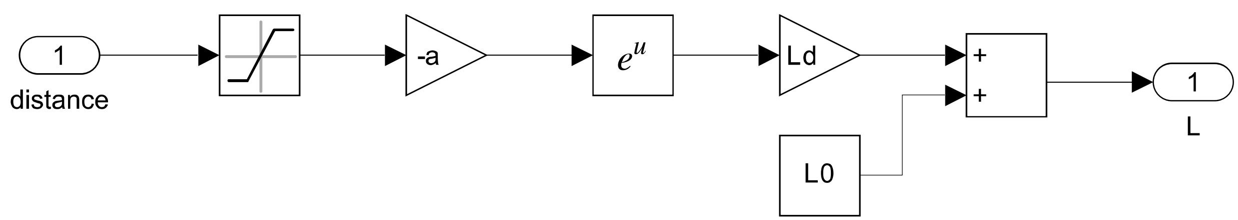



Cd
A
rho
1
v
x
1/2
1
Fd

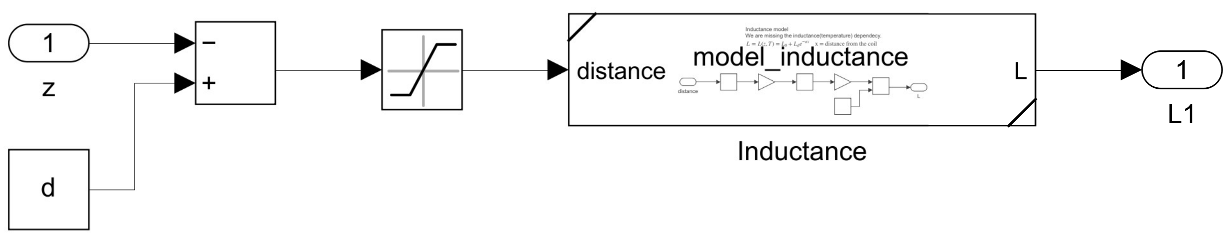
$$L_1 = L(z)$$



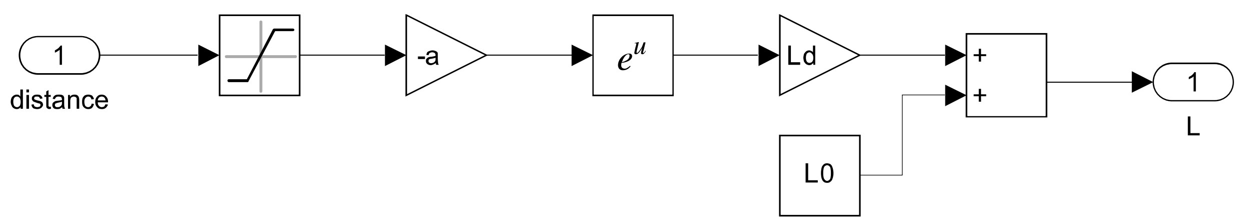
Inductance model
We are missing the inductance(temperature) dependecy.
$L = L(z,T) = L_0 + L_d e^{-ax}$ x = distance from the coil

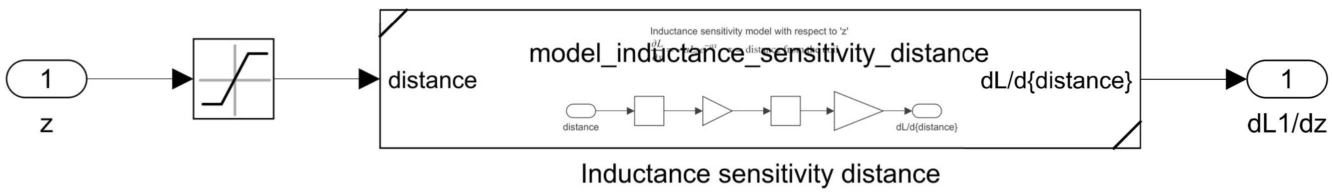


$$L_2 = L(d - z)$$



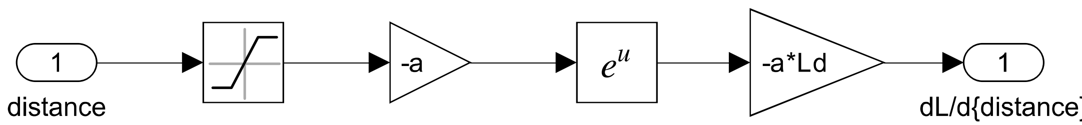
Inductance model
We are missing the inductance(temperature) dependecy.
$L = L(z,T) = L_0 + L_d e^{-ax}$ x = distance from the coil

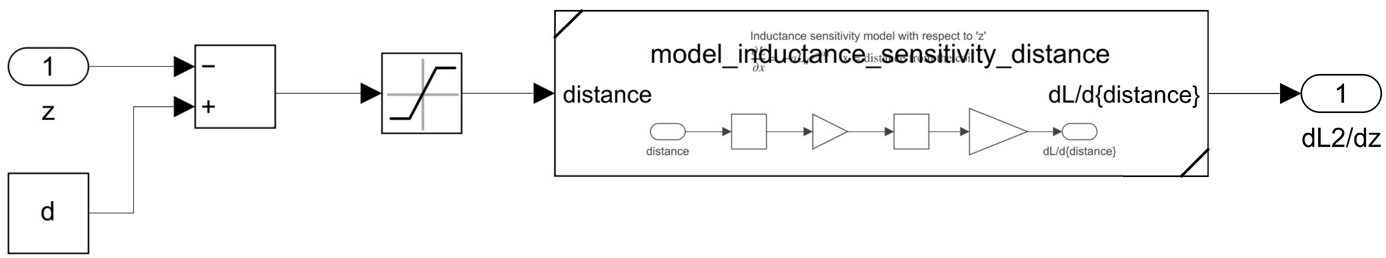



1
z
distance
model_inductance_sensitivity_distance
Inductance sensitivity model with respect to 'z'
dL/d{distance}
1
dL1/dz
Inductance sensitivity distance

Inductance sensitivity model with respect to 'z'

$$\frac{\partial L}{\partial x} = -aL_d e^{-ax} \quad \text{x = distance from the coil}$$




1
z
−
+
d
Inductance sensitivity model with respect to 'z'
model_inductance_sensitivity_distance
distance
dL/d{distance}
distance
dL/d{distance}
1
dL2/dz

Inductance sensitivity model with respect to 'z'

$$\frac{\partial L}{\partial x} = -aL_d e^{-ax} \quad \text{x = distance from the coil}$$