Magnetic levitation force produced by the EMS system is:

$$F_m = \frac{\emptyset^2}{\mu_0 A_g} = \frac{MMF_{total}^2}{\mu_0 A_g R_{total}^2} = \frac{(2H_c l + NI)^2}{\mu_0 A_g R_{total}^2} = \frac{\mu_0 A_g (2H_c l + NI)^2}{4z^2}$$

N= number of turns

H_c= magnetic field intensity of magnet

A_g= effective cross sectional area of air gap

l= length of magnet in magnetization direction

Z= air gap distance

I= current input to the coils

MMF_{total}= total magnetomotive force from permanent magnets and coils

$\emptyset$= magnetic flux of the air gap

R_{total}= total reluctance

Where R_{total} is as follow:

$$R_{total} = \frac{(\Re_{track} + 2\Re_{airgap})(\Re_{leakage} + \Re_{magnet}) + \Re_{magnet}\Re_{leakage}}{\Re_{leakage} + 2\Re_{airgap} + \Re_{track}}$$

Equation motion for the conveyor:

$$m\ddot{z}(t) = mg + f_d(t) - F(i(t), z(t))$$

Where,

$m = equivalent\ mass$

$g = accleration\ due\ to\ gravity = 9.81\ m/s^2$

$f_d = disturbance\ force$

Electrical input supply voltage is:

$$V(t) = RI(t) + \frac{\mu_0 A_g N^2}{2z(t)}\frac{di(t)}{dt} - \frac{\mu_0 N^2 A_i(t)}{2z(t)^2}\frac{dz(t)}{dt}$$

Where;

The second equation indicates varying inductance

The third equation indicates varying voltage with respect to changes in airgap, z