



EZSLAM

INSTALLATION/SOFTWARE/USAGE

Q: Question

What is the calculation of M.C.E. Loss to Friction and relationship between M.C.E. Loss to Friction and Provided by Spring?

A: Answer

Door Check + Hinge System related, opening/closing the door from fully open to near closed.

In this region there are 3 forces or energy's

At any point during the movement, we experience

- Force from the user: Push Pull in the direction of the movement " F_{user} "
- Force from the check and hinge
 - Friction (lost) : against the direction of movement " $F_{friction}$ "
 - Spring (forces that recoverable): independent of direction of movement " F_{spring} "
- Force from gravity: Always pull " $F_{gravity}$ "

Sweep Force decomposition

$$F_{user} = F_{friction} + F_{spring} + F_{gravity}$$

When integrated over the travel expressed as Energy

$$E_{user} = E_{friction} + E_{spring} + E_{gravity}$$

For the opening Sweep we get

$$E_{user\ open} = E_{friction} + E_{spring} + E_{gravity}$$

Closing Sweep (Spring and gravity change signs because of the direction)

$$E_{user\ close} = E_{friction} - E_{spring} - E_{gravity}$$

If we combine the open and close sweep together (add the open energy to closing sweep energy)

$$E_{user\ open} + E_{user\ close} = (E_{friction} + E_{spring} + E_{gravity}) + (E_{friction} - E_{spring} - E_{gravity})$$

or after simplification (assuming the friction in both directions are similar)

$$E_{user\ open} + E_{user\ close} = 2 * E_{friction}$$



In other words, if we open the door and close the door immediately, energy given by gravity is also recovered, energy given by the check that can be recovered, is recovered.

$$E_{\text{friction}} = (E_{\text{user open}} + E_{\text{user close}}) / 2$$

As a next step we can already determine the influence from gravity based on the door rise and associated potential energy (Reducing all parameters to Center of Gravity)

$$E_{\text{gravity}} = \text{Height}_{\text{DoorRise}} \times \text{Weight} \times 9.81$$

If we complete all the known elements together

$$E_{\text{user close}} = E_{\text{friction}} - E_{\text{spring}} - E_{\text{gravity}}$$

Or re-arranged based on what is known

$$E_{\text{spring}} = - E_{\text{user close}} + E_{\text{friction}} + E_{\text{gravity}}$$

For this calculation to work the session has to have the

- Open and Close Sweep (Energy)
- Slams (Door Rise)
- Wiggle (Inertia & weight)

(*) to improve weight accuracy, we recommend using an accurate door geometry description