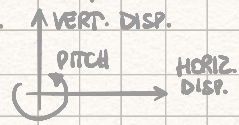
14/09

INTRODUCTION ON DYNAMICS OF MECHANICAL SYSTEMS

↳ Dynamics = relation between FORCES (inputs) and movements of a mech. system.

There are 2 types of mech. systems:

- LUMPED PARAMETER SYSTEMS → they have N d.o.f. (finite number) (ex. car on a bumping road can be considered as a rigid body, because we can define each point of the car just by knowing 3 parameters, such as vertical and horiz. displacement and pitch rotation).



They're described by n ordinary diff. equations (ODEs)

- DISTRIBUTED PARAMETER SYSTEMS → FLEXIBLE SYSTEMS → ∞ d.o.f.

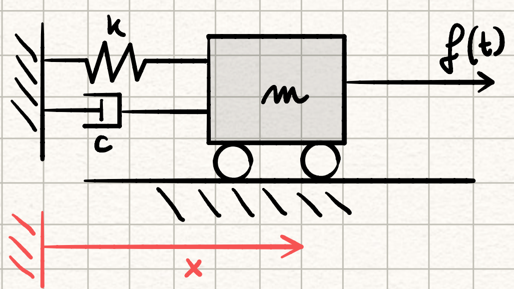
They're described by partial derivative diff. equations (PDEs)

But there are no solutions for PDEs so we'll use approximate solutions ⇒ DISCRETIZATION

FINITE ELEMENT METHOD

Very general method to reduce a set of PDEs to ODEs

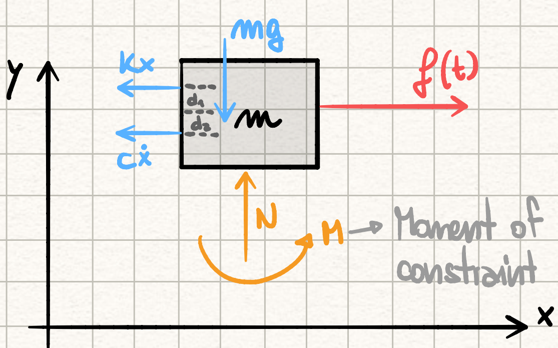
RECAP ON METHODS FOR A 1 DoF SYSTEM



Since this is a rigid body in traslatory only motion ⇒ every point of m has the same velocity.

METHOD 1) NEWTON'S II LAW :

$$\begin{cases} \sum \vec{F} = m\vec{a} \\ \sum \vec{M}_o = J_o \dot{\vec{\omega}} \end{cases}$$



(We move x and ẋ to the positive direction and w.r.t that we have the direction of the damping and elastic forces)