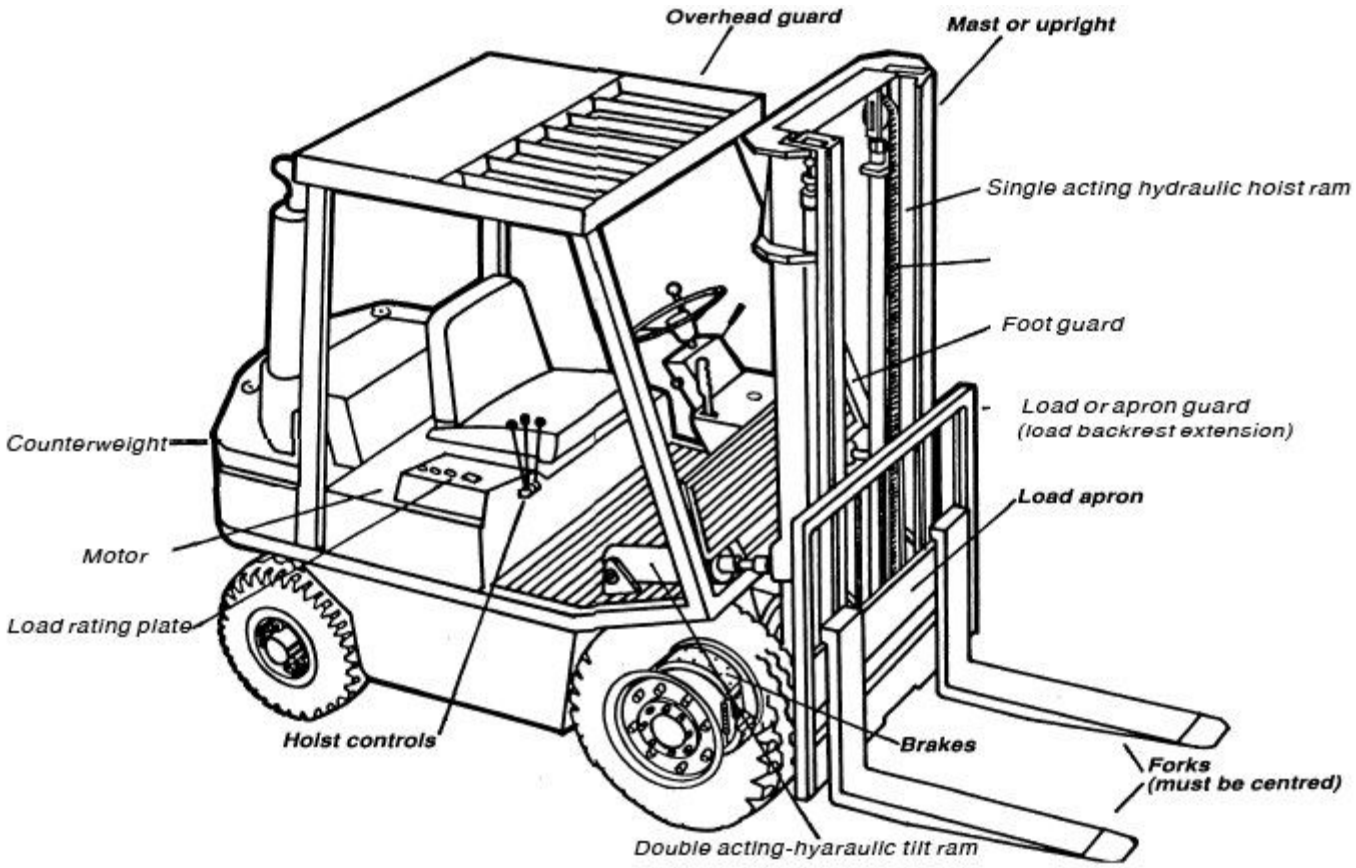
POLITECNICO DI MILANO

Finite Element Simulation For Mechanical Design

Deflection of a forklift mast

Prof. Andrea Bernasconi

Analysis of a forklift



https://www.prolifttoyota.com/blog/forklift-uprights/

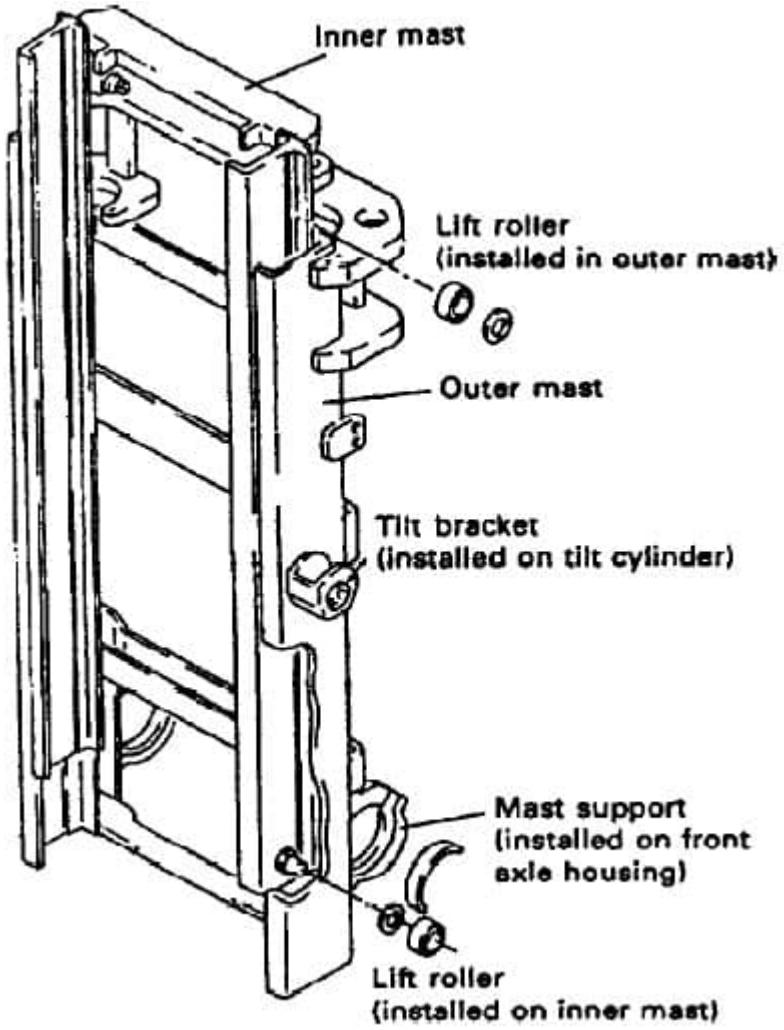
Forklift mast

The forklift mast is the set of nested, U-shaped or L-beam steel rails. A telescoping lift assembly uses one fixed set of rails and one, two or three sets of movable rails to gain double, triple or quad stage lift.

Rails are tied together with a series of tie bars. These tie bars make the two rails of each stage rigid and prevent the mast from twisting when put under load.

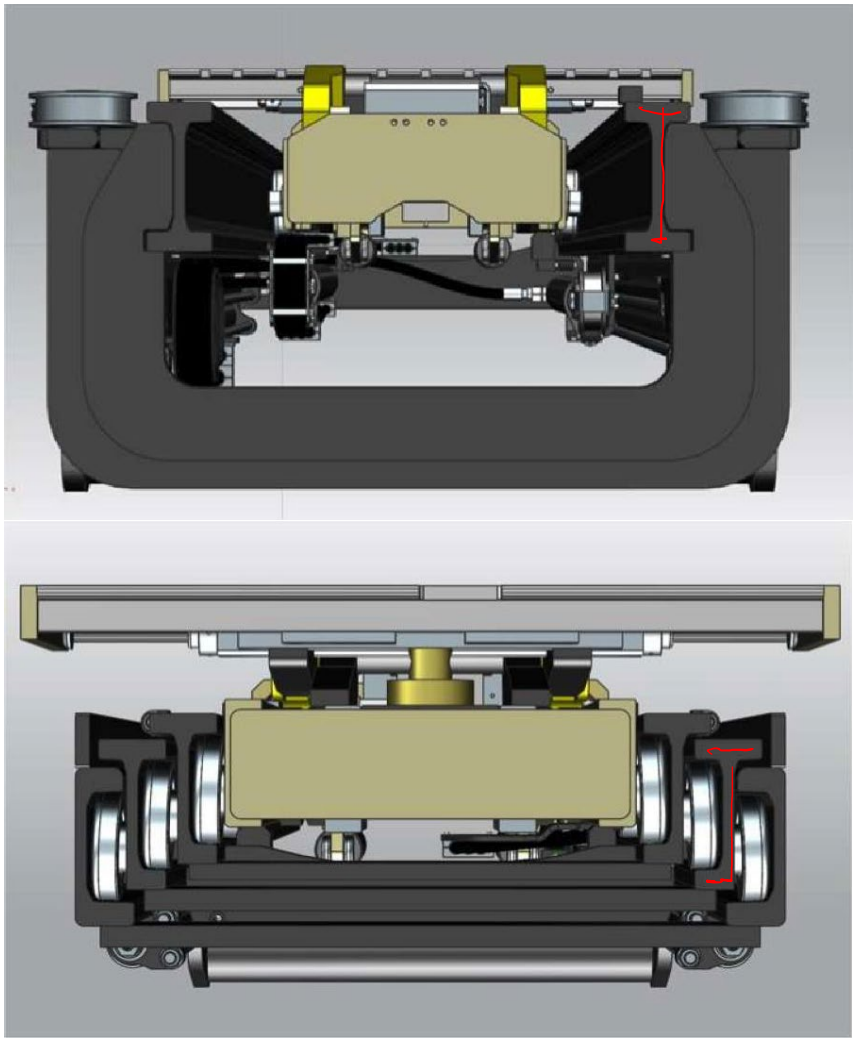
Each set of rails has a set of rollers attached at two or three points along its length. The rollers allow the rails to move smoothly as the upright assembly is extended

Chains are connected to the carriage and mast at points called anchors. The chains are looped over pulleys, called sheaves, attached to the lift cylinder or a set of rails. The chain provides a second indirect stage of lift in addition to the direct lift provided by the lift cylinders.



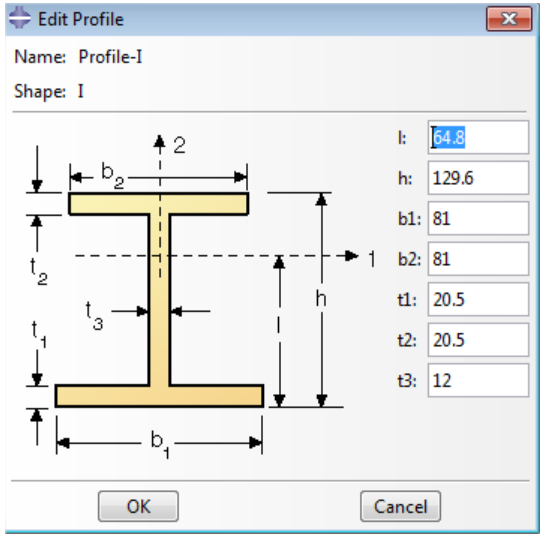
https://www.prolifttoyota.com/blog/forklift-uprights/

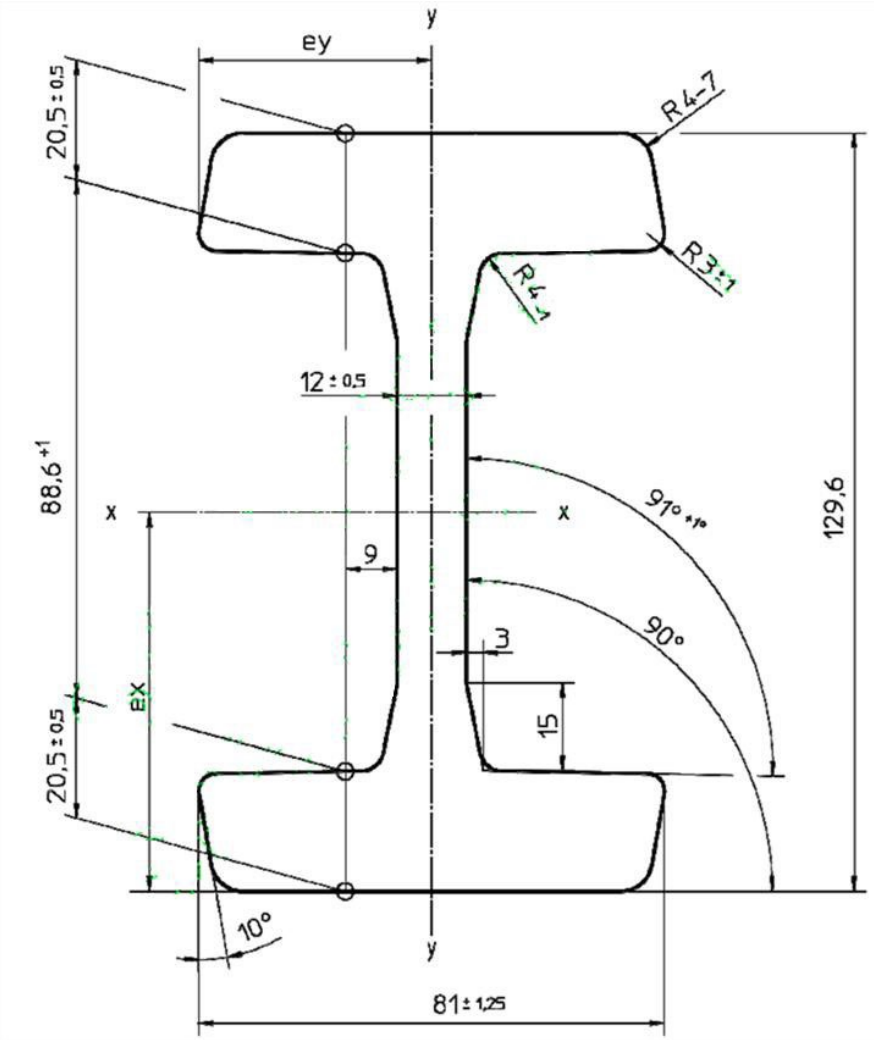
Details of the mast



Example

Rail properties





Example

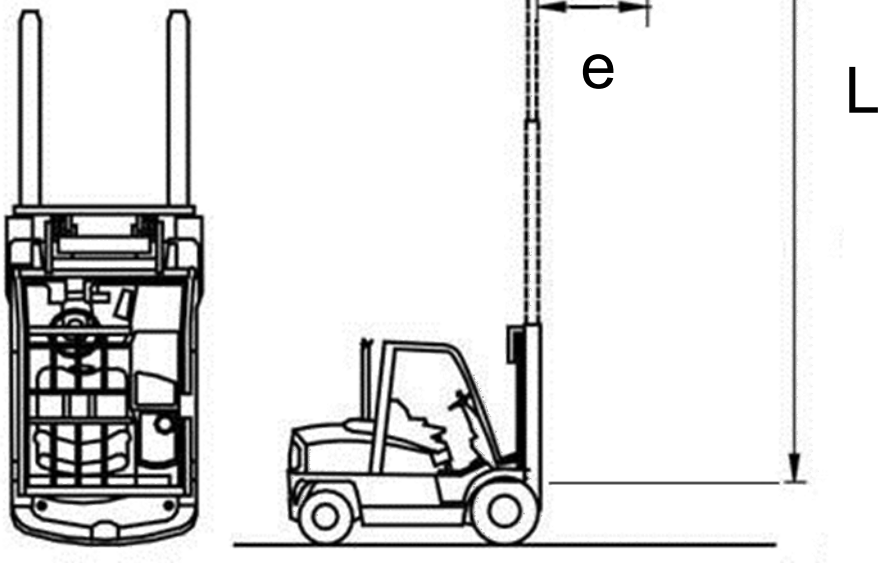
m = 2000 kg

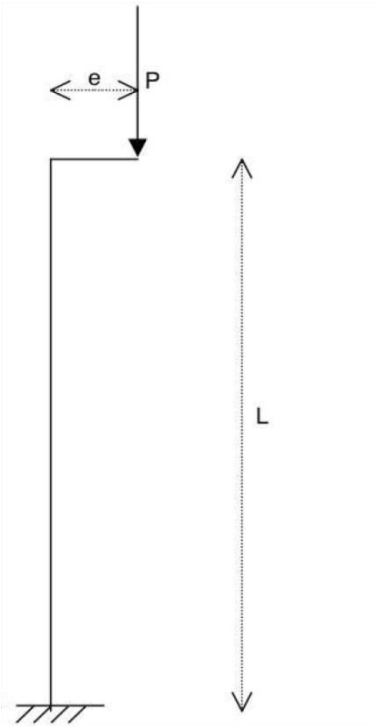
P = mg/2 = 9810 N

L = 10 000 mm e = 600 mm

I = 10372190 mm^4

$$\delta = \frac{PeL^2}{2EI} = 137.7 \text{ mm}$$





Is the FE analysis correct?