

Università degli Studi di Padova – Dipartimento di Ingegneria Industriale

Corso di Laurea in Ingegneria Meccanica

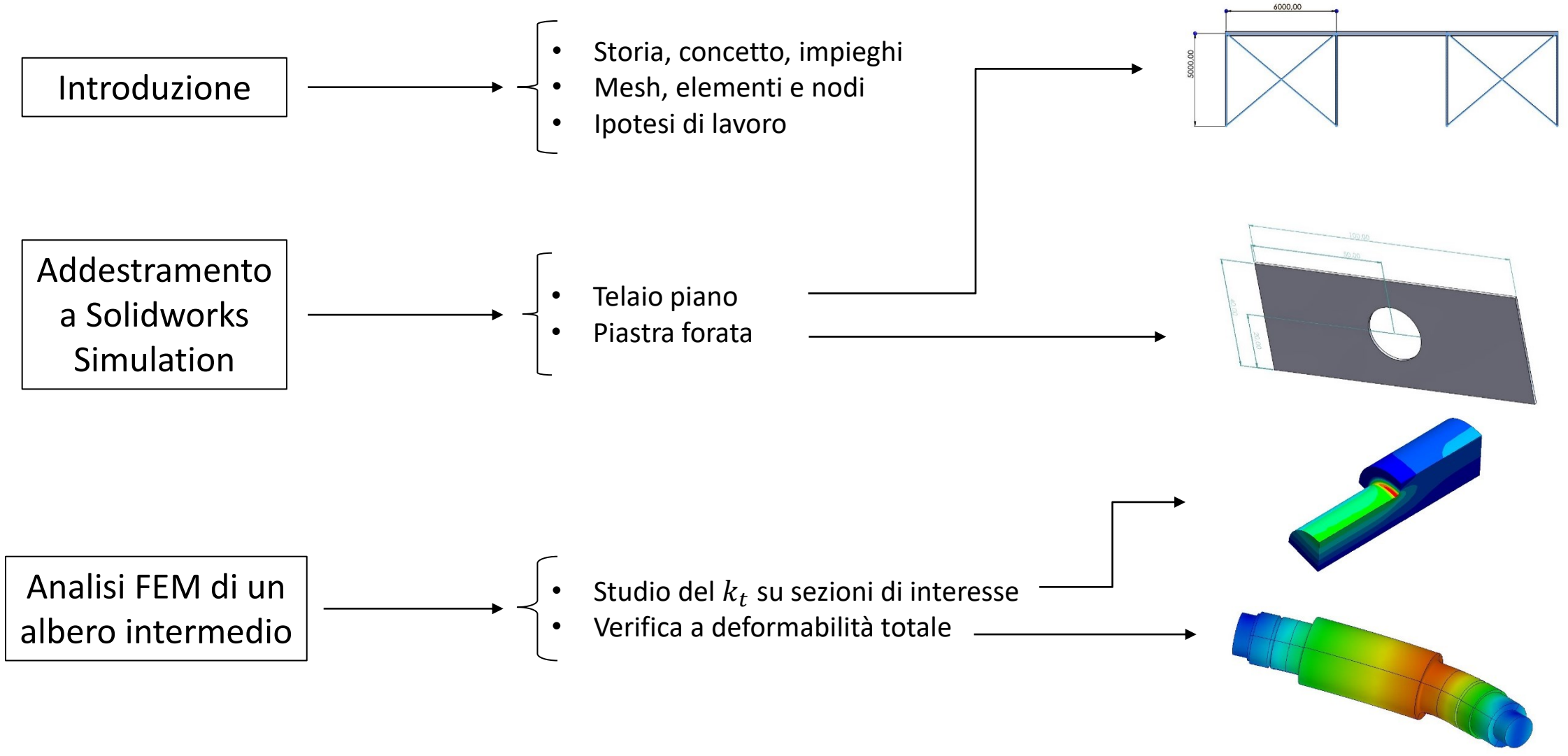
***Relazione per la prova finale***  
***Analisi FEM strutturali di un riduttore bistadio mediante***  
***Solidworks Simulation®***

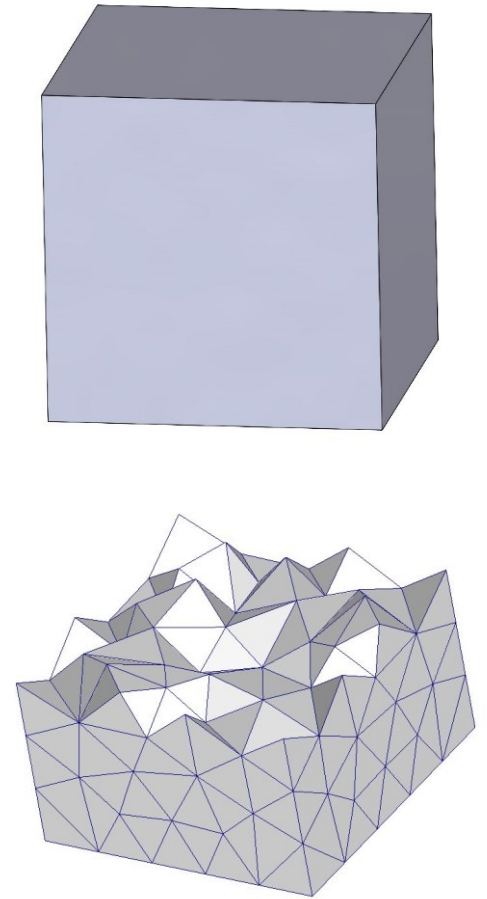
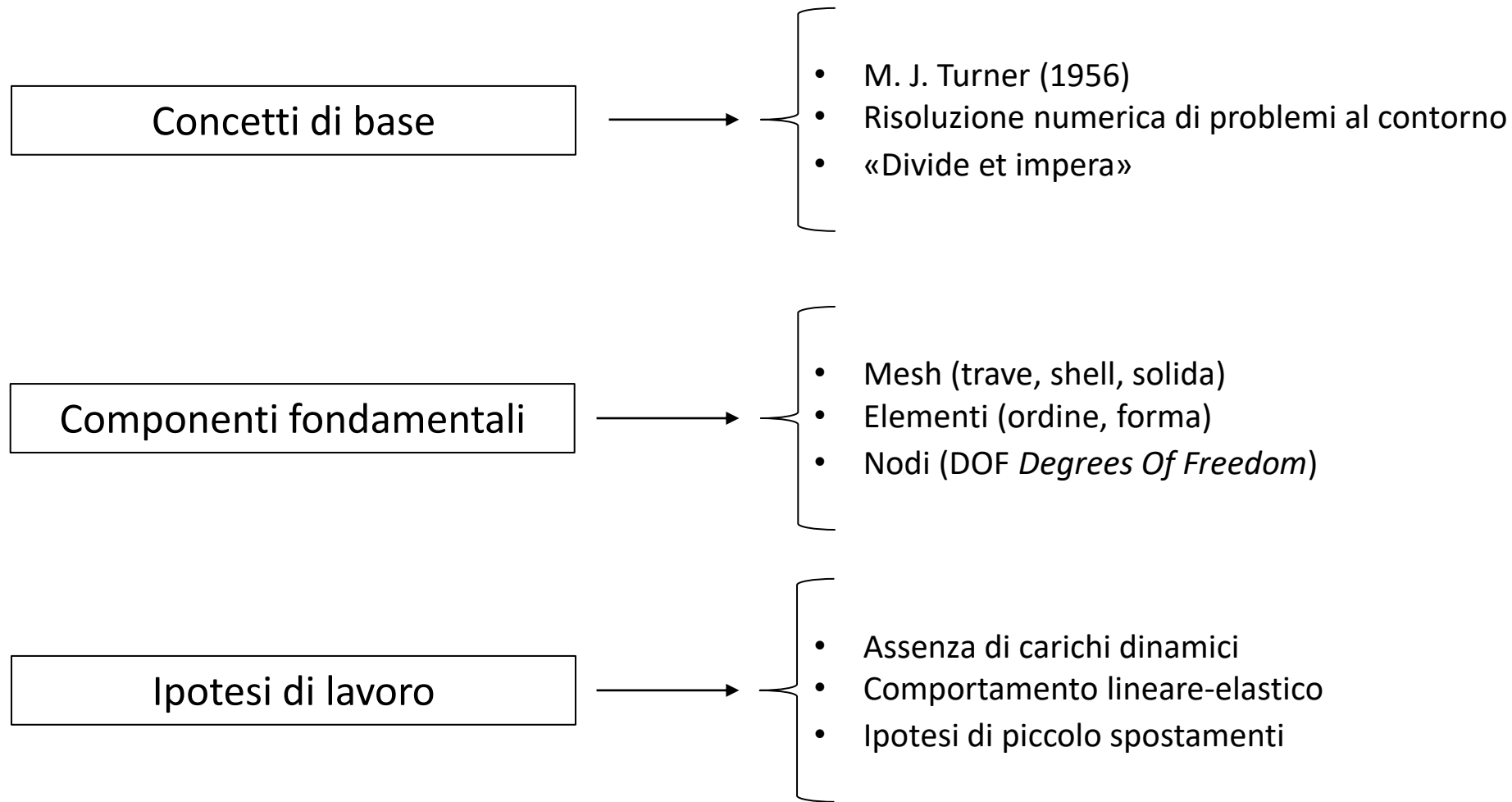
Tutor universitario: Ch.mo Prof. Alberto Campagnolo

Laureando: Francesco Piva

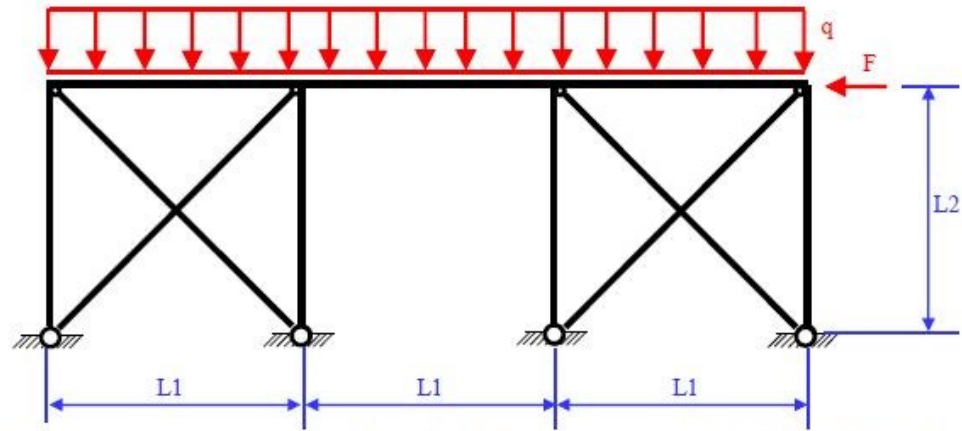
Matricola: 1216776

Padova, .../.../2023





## DEFINIZIONE DEL PROBLEMA

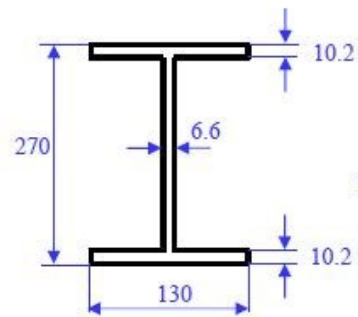


**DATI**  
F = 60 kN  
q = 20 kN/m  
L1 = 6000 mm  
L2 = 5000 mm

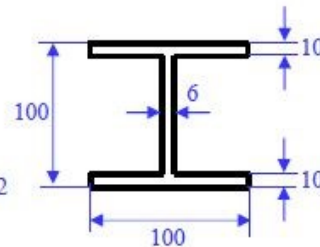
**MATERIALE**  
Acciaio Fe 430  
 $\sigma_{adm} = 190$  MPa  
E = 206000 MPa  
 $\nu = 0.3$

**PROFILI ADOTTATI**  
Corrente superiore: IPE 270  
Colonne: HE 100 B  
Controventi: L 40x4

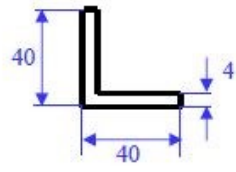
### PROFILI



Corrente superiore: IPE 270



Colonne: HE 100 B



Controventi: L 40x4



## RISULTATI

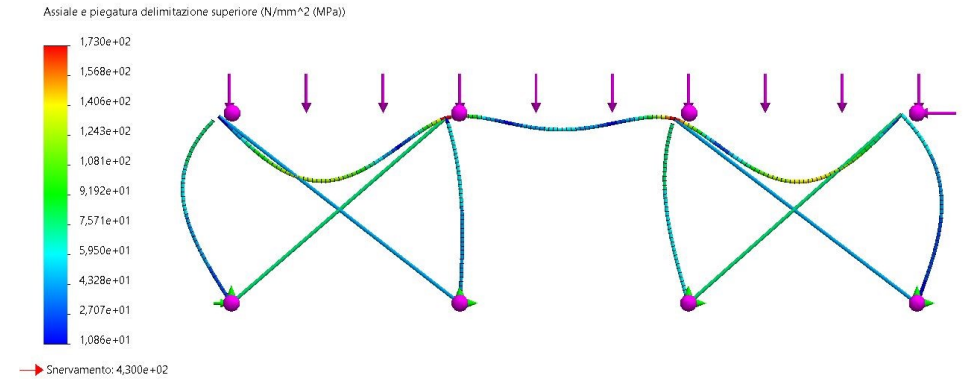
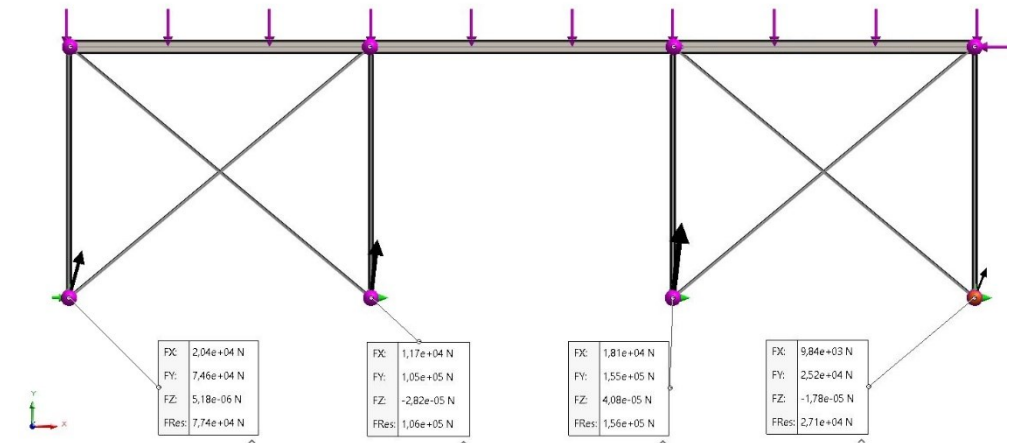


Grafico tridimensionale di sollecitazione, con scala di deformazione 116:1



Reazioni vincolari

## RISULTATI: DIAGRAMMA TRAVE

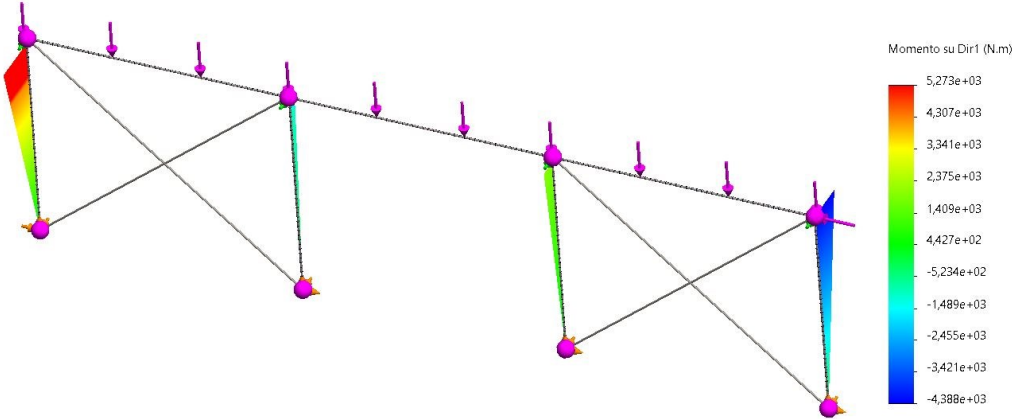


Diagramma momento flettente lungo direzione x (N m).

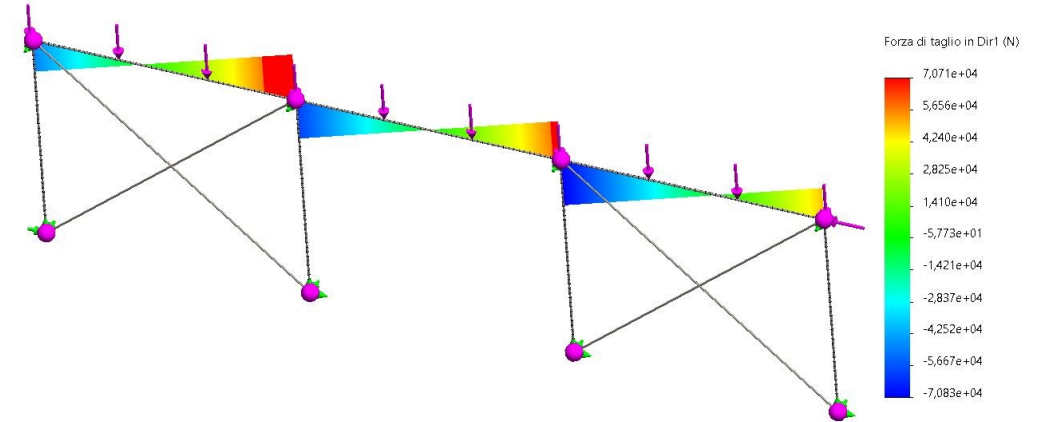


Diagramma taglio lungo direzione y (N).

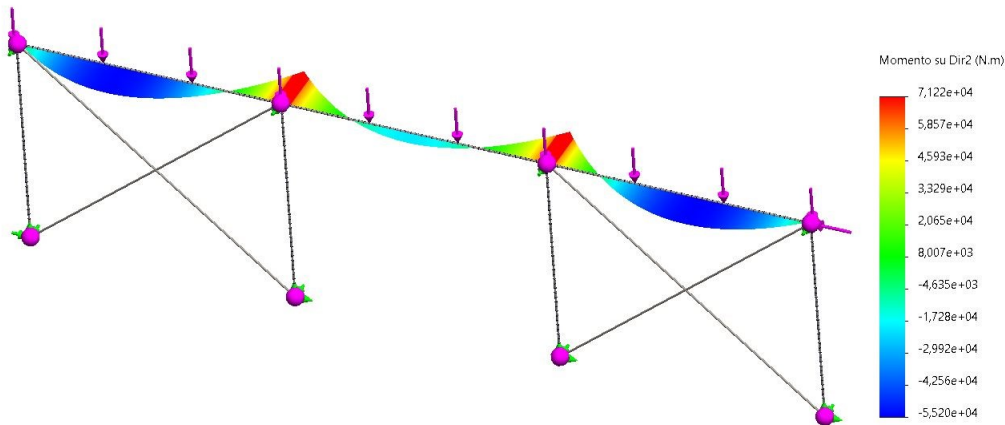


Diagramma momento flettente lungo direzione y (N m).

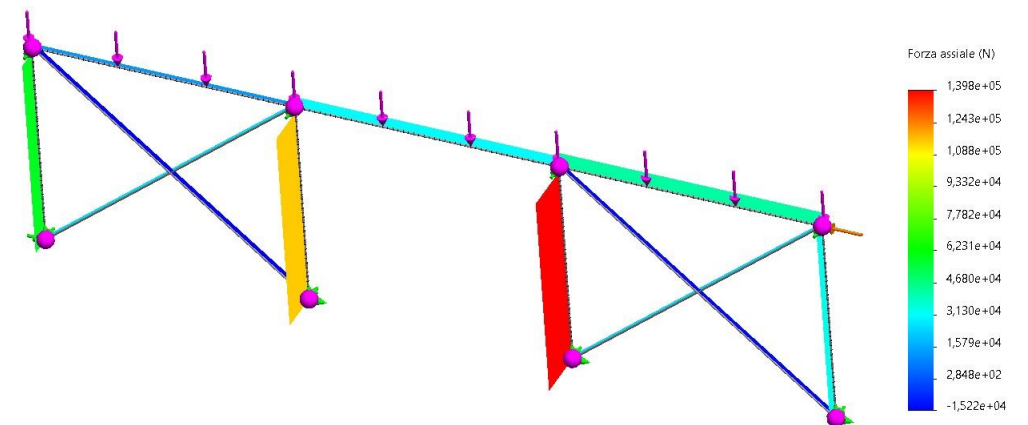
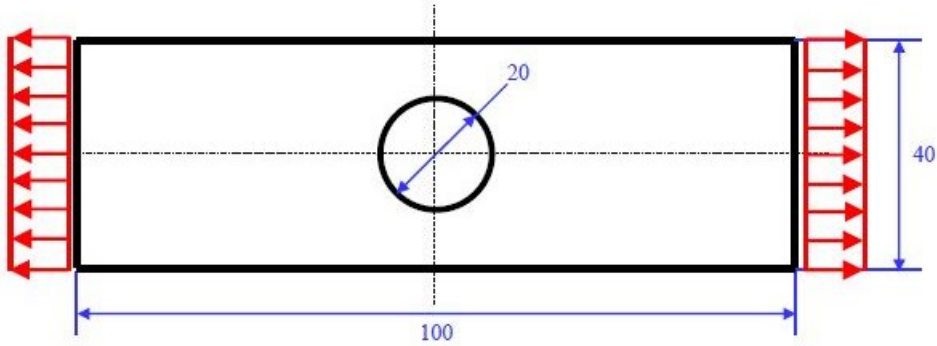


Diagramma sforzo assiale (N).

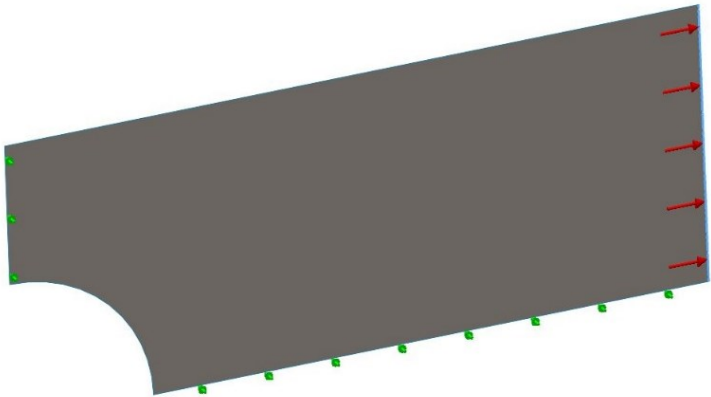
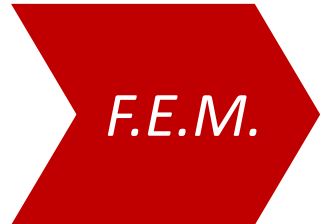


## DEFINIZIONE DEL PROBLEMA

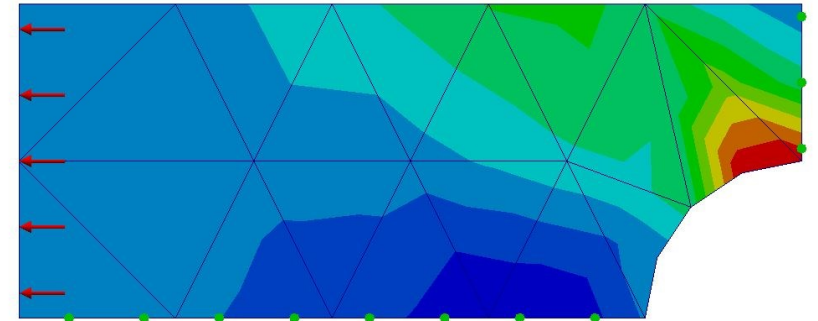


**DATI**  
Spessore piastra = 1 mm

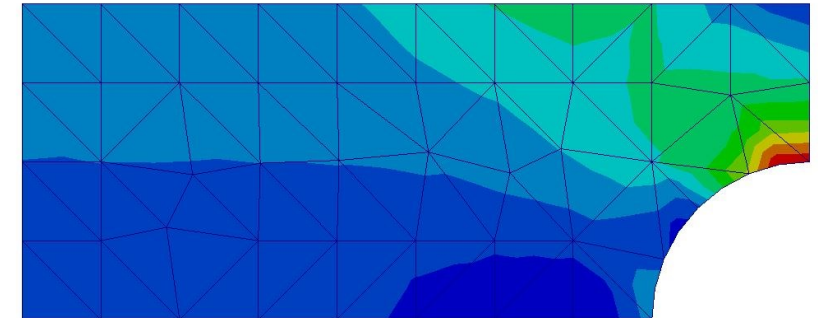
**MATERIALE**  
Acciaio Fe 360  
E=206000 MPa  
v=0.3



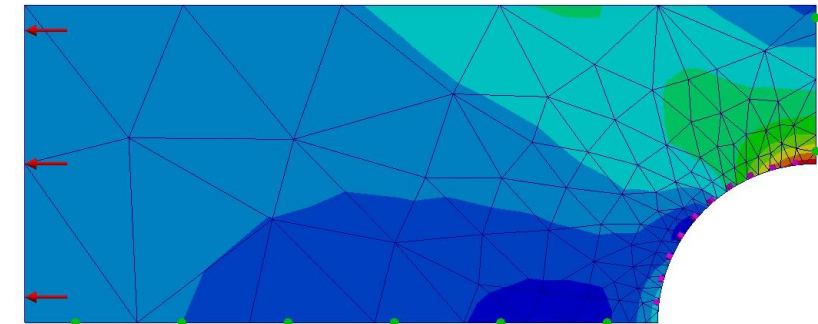
- Carichi (1 MPa)
- Vincoli (Simmetria)



Mesh con dimensione media elemento pari a 10 mm.



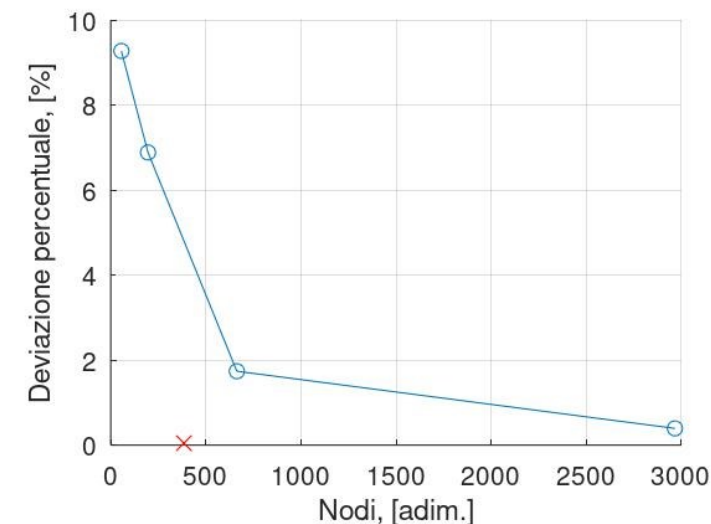
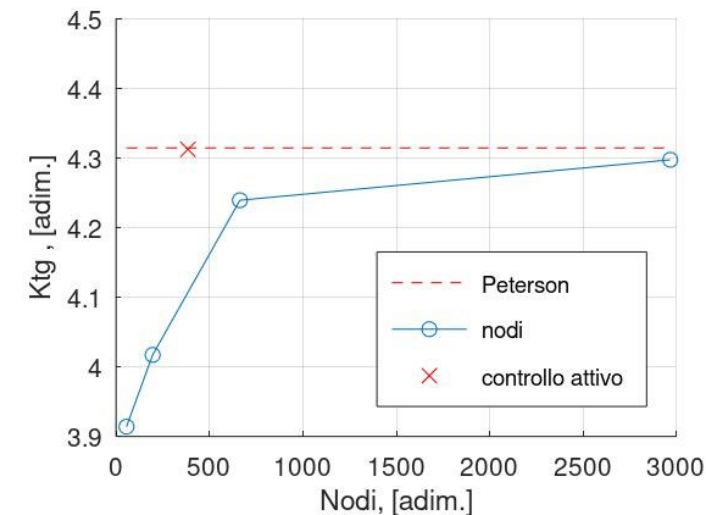
Mesh con dimensione minima elemento pari a 5 mm.



Mesh con dimensione elemento variabile (min = 1.25 mm).

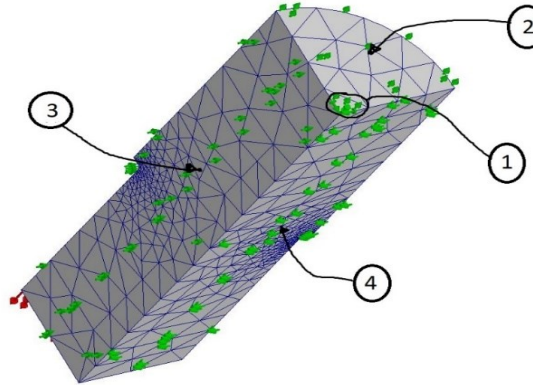
## RISULTATI

Spessore elemento	Nodi	$K_{t,Peterson}$	$K_{t,FEM}$	Dev. %
10 mm	56	3,914	4,314	9,27
5 mm	196	4,017	4,314	6,88
2.5 mm	663	4,239	4,314	1,74
1.25 mm	2966	4,297	4,314	0,39
variabile	385	4,312	4,314	0,05



## Vincoli

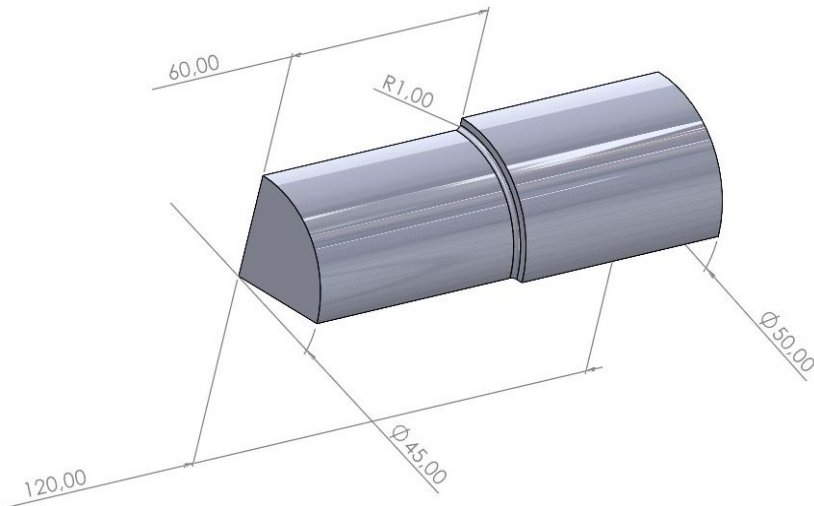
- Punto fisso al vertice 1
- Bloccate traslazioni normali alla faccia 2
- Bloccate traslazioni normali alla faccia 3
- Consentiti spostamenti normali alla faccia 4



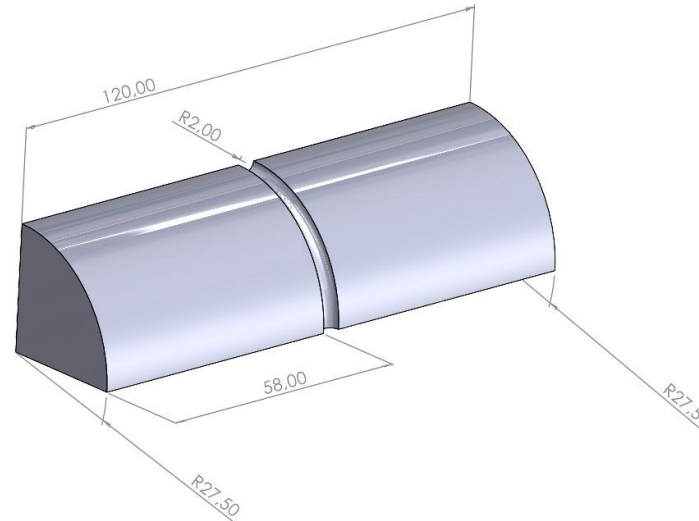
## Carichi

- Sollecitazione di momento flettente tale da raggiungere tensione massima lorda unitaria.

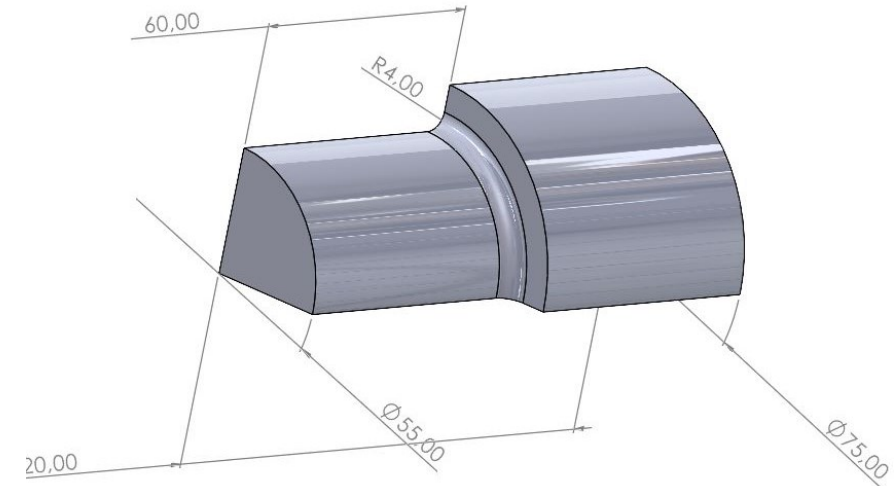
Sezione A  
(spallamento cuscinetto sinistro)



Sezione B  
(gola di scarico)

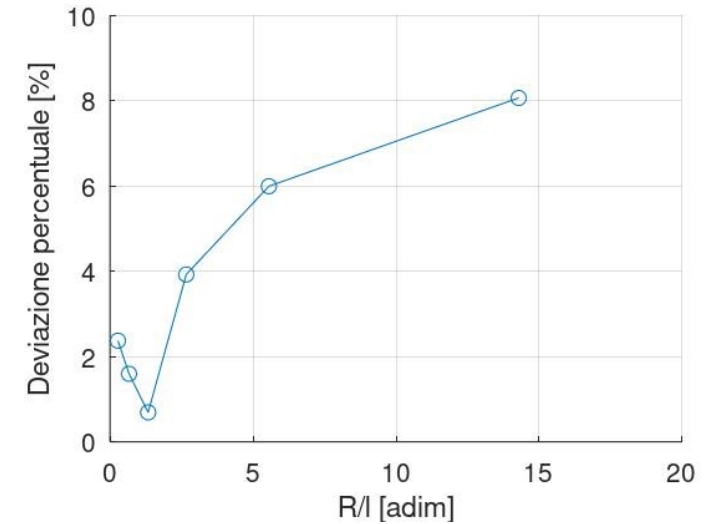
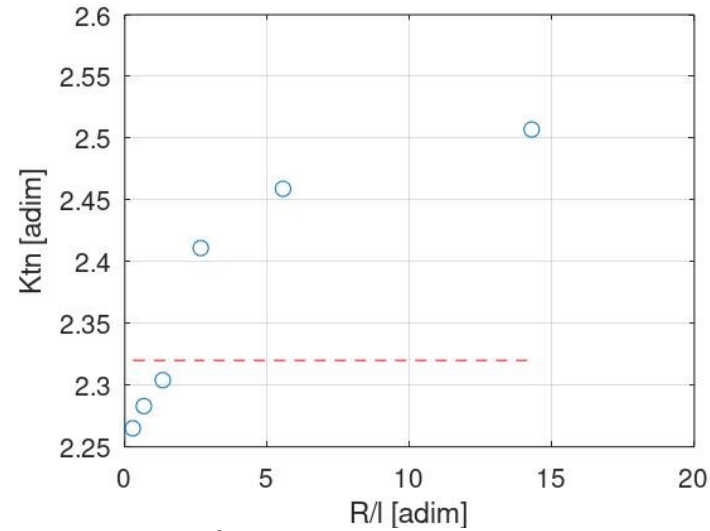
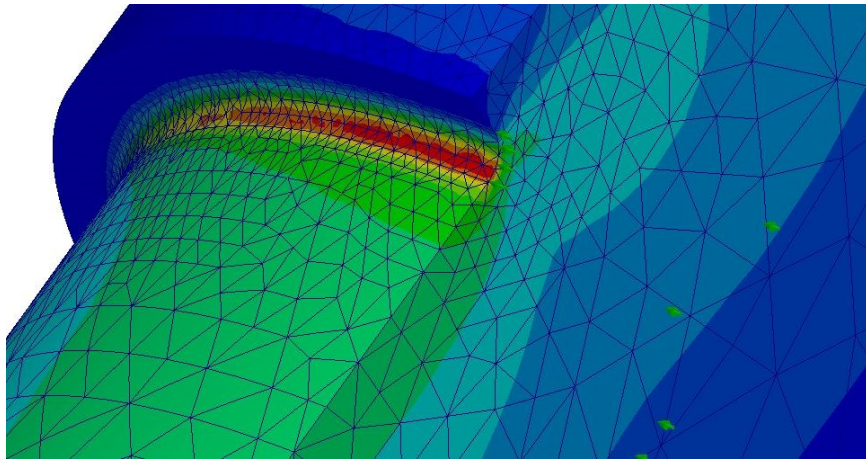


Sezione C  
(spallamento ruota dentata)

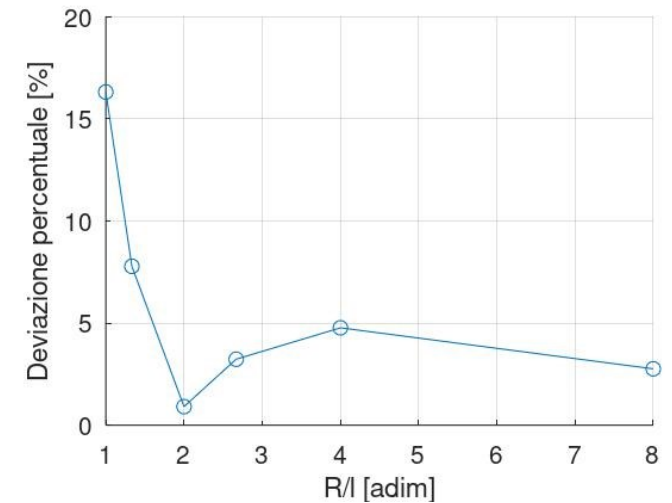
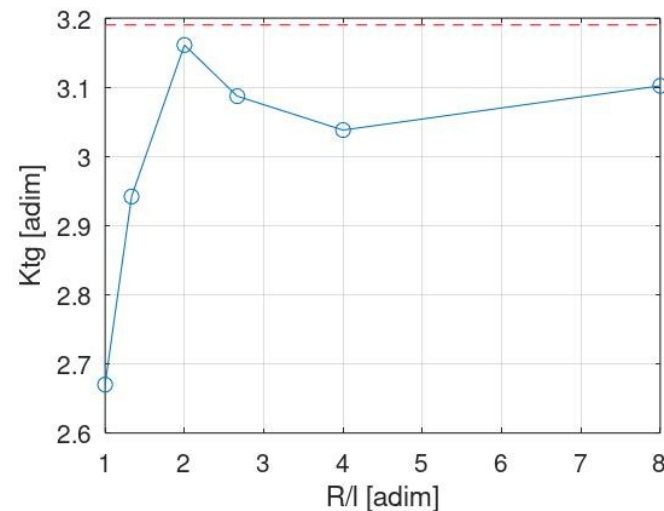
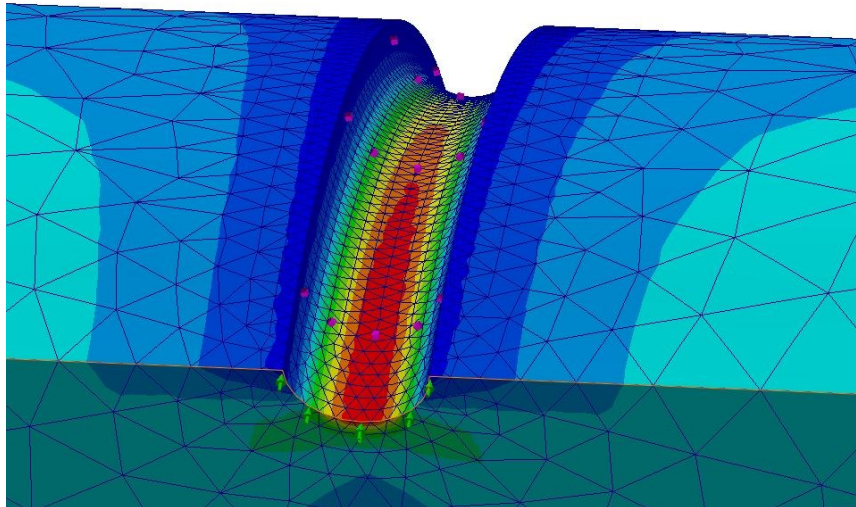




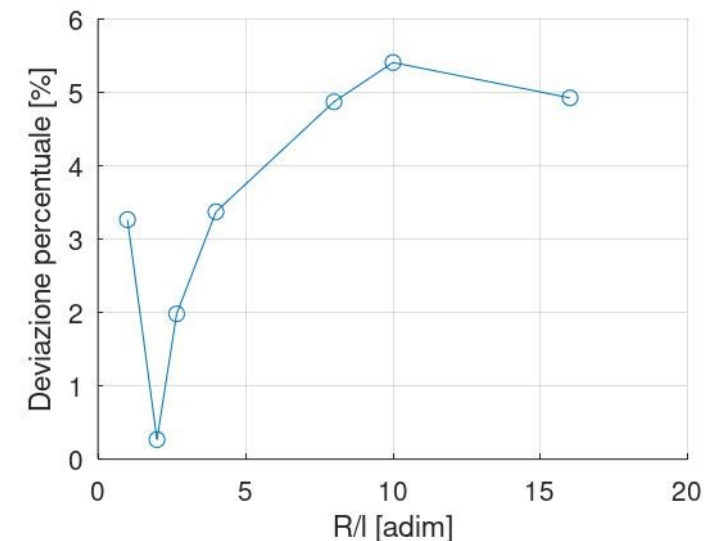
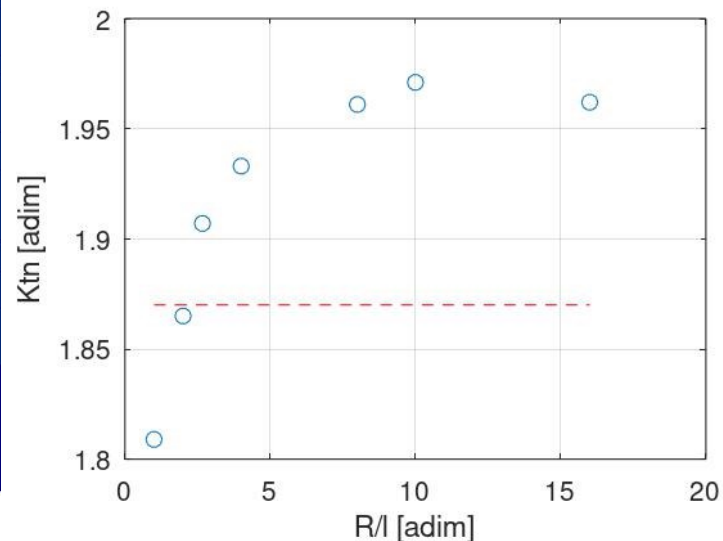
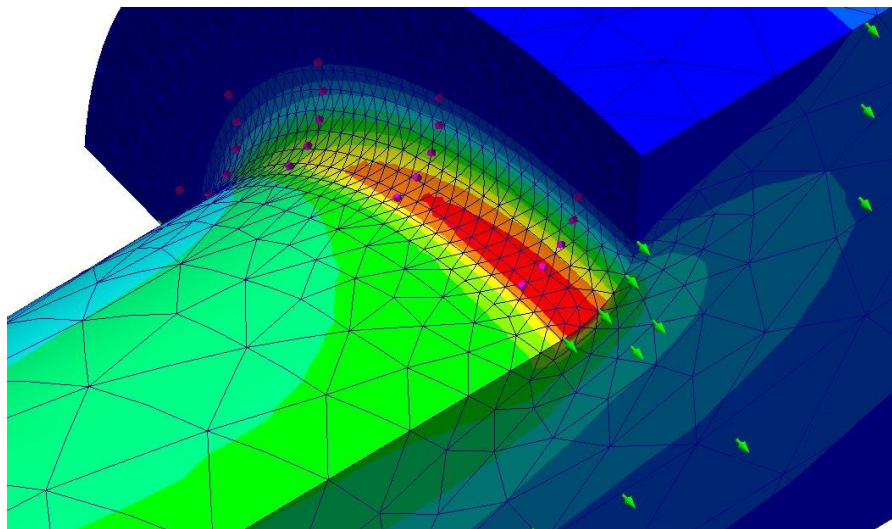
SEZIONE A (Sezione di spallamento cuscinetto a sfere)



SEZIONE B (Gola di scarico della filettatura)

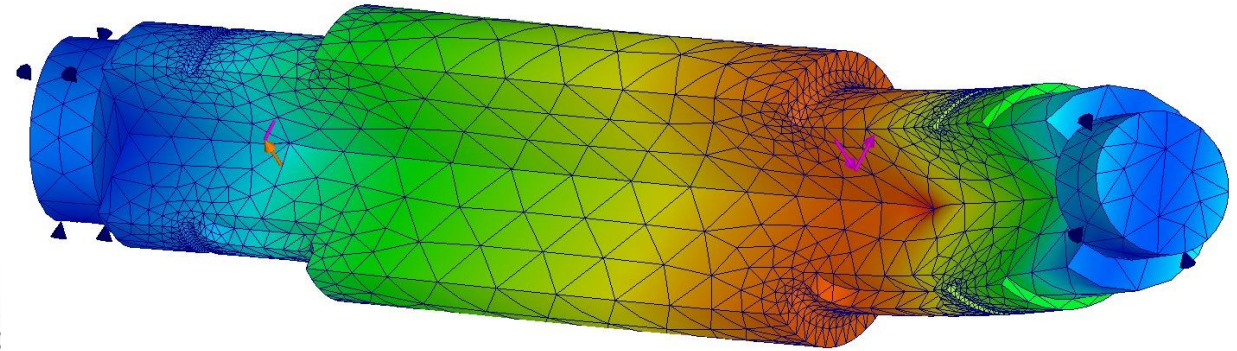
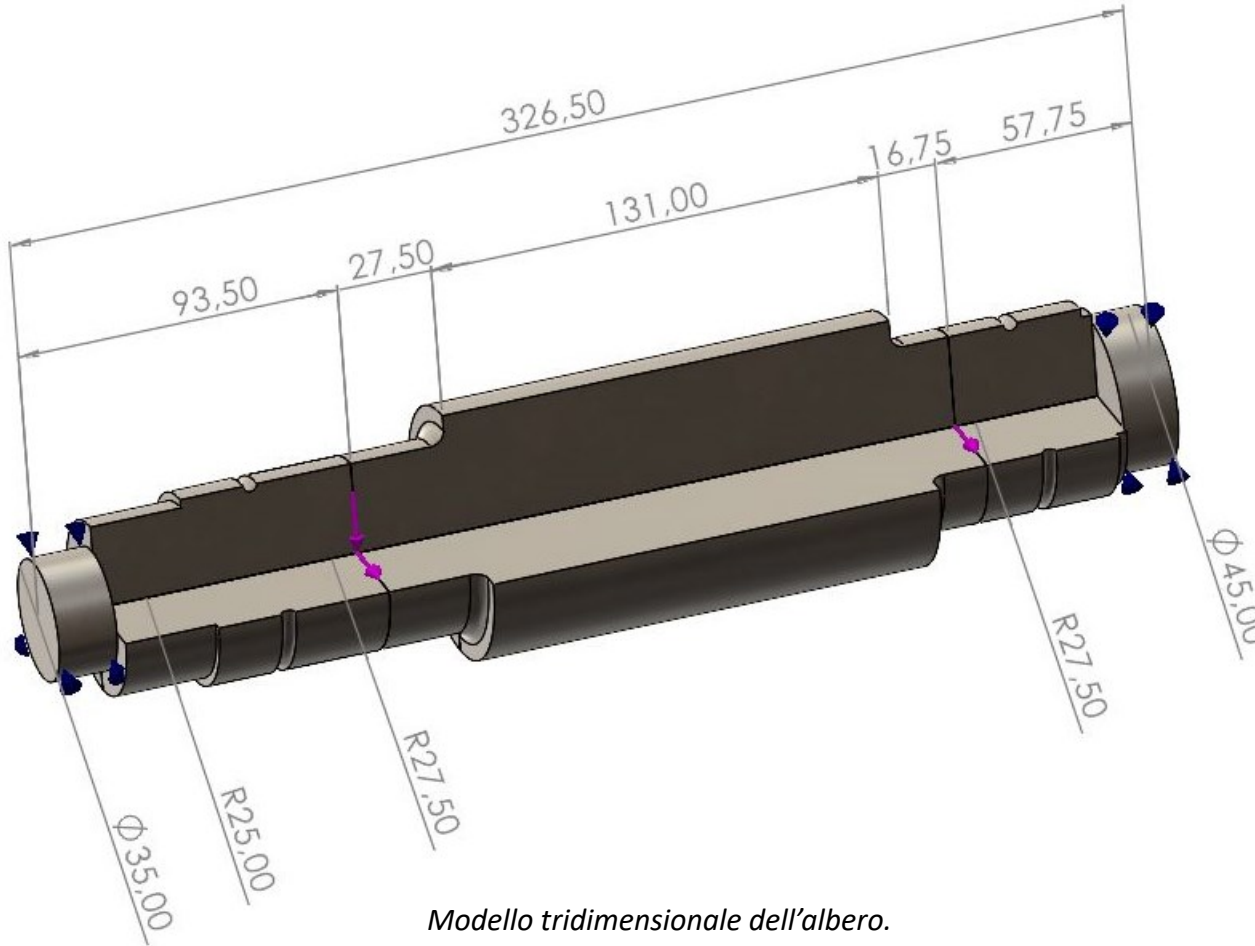


SEZIONE C (Sezione di spallamento ruota dentata)

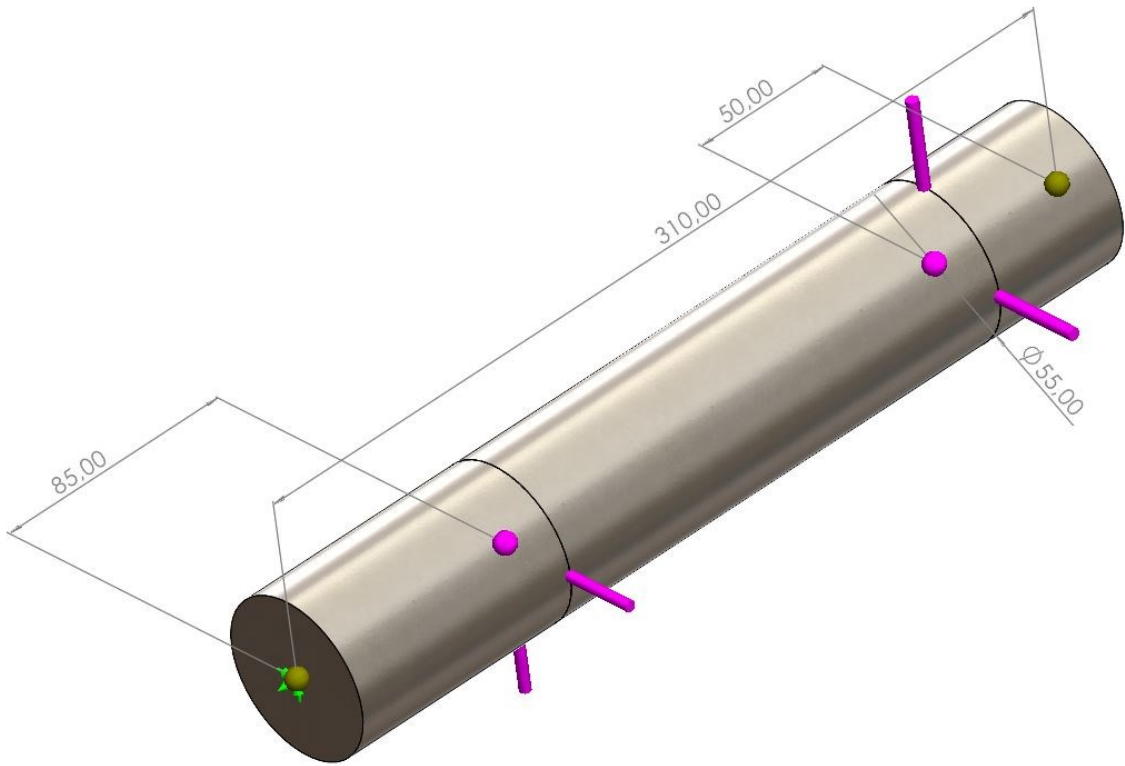


RISULTATI: Studio del  $k_t$  a flessione

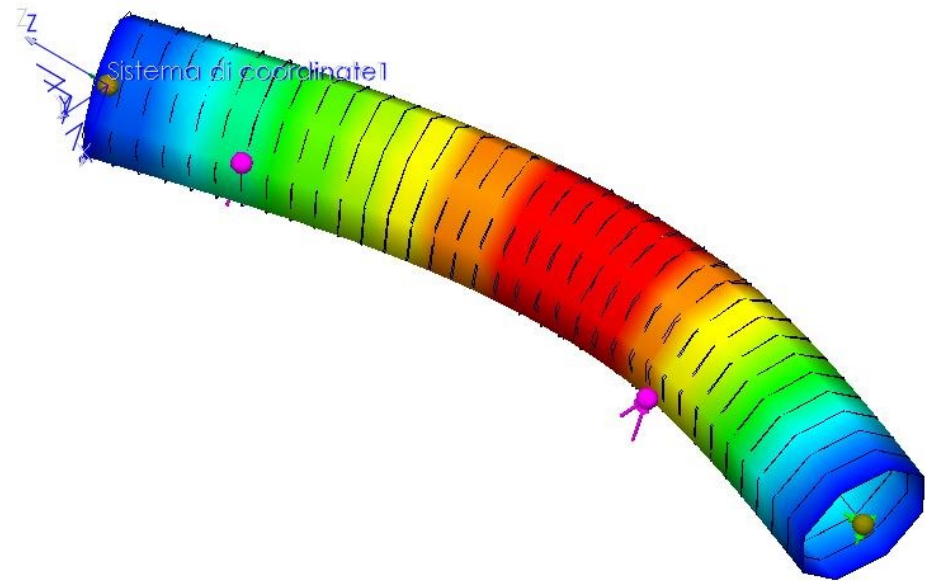
Sezione	$K_t$ teorico	$K_t$ FEM	$\Delta\%$	$R/l$
A	2,32	2,304	0,67%	1,33
B	3,19	3,161	0,91%	2
C	1,87	1,865	0,27%	2



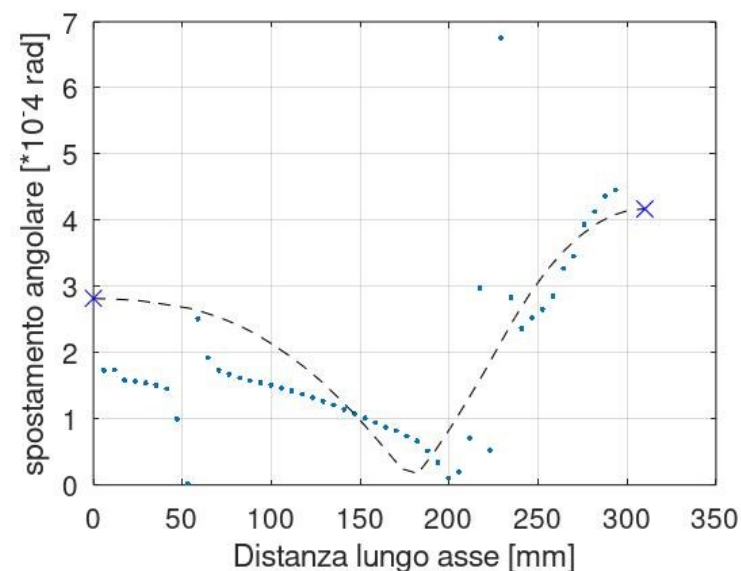
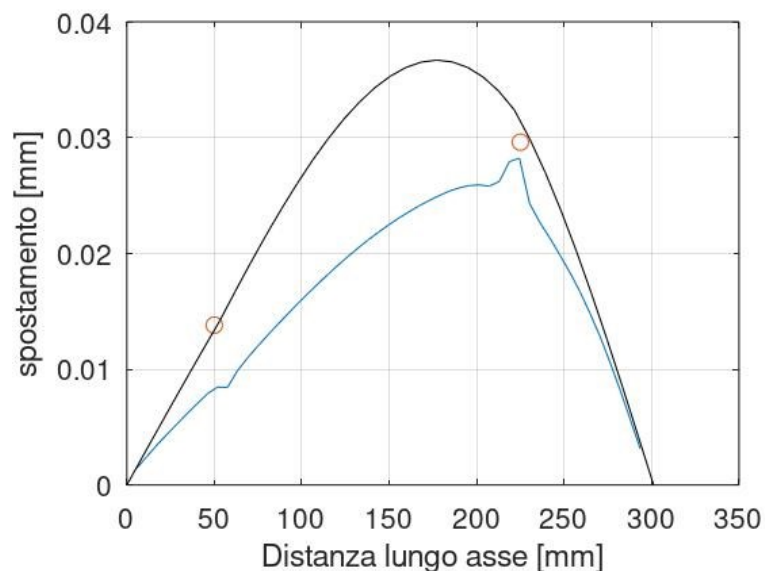




*Modello monodimensionale dell'albero.*



*Grafico della deformata del modello monodimensionale.*



## RISULTATI: Verifiche a deformabilità

Modello	Spostamento ruota 2	Spostamento ruota 3	Rotazione cuscinetto sfere	Rotazione cuscinetto rulli
Solido	$8,45 \cdot 10^{-3} mm$	$2,82 \cdot 10^{-2} mm$	$1,73 \cdot 10^{-4} rad$	$4,45 \cdot 10^{-4} rad$
Trave	$1,41 \cdot 10^{-2} mm$	$3,24 \cdot 10^{-2} mm$	$2,82 \cdot 10^{-4} rad$	$4,17 \cdot 10^{-4} rad$
Analitico	$1,38 \cdot 10^{-2} mm$	$2,96 \cdot 10^{-2} mm$	$2,82 \cdot 10^{-4} rad$	$4,17 \cdot 10^{-4} rad$