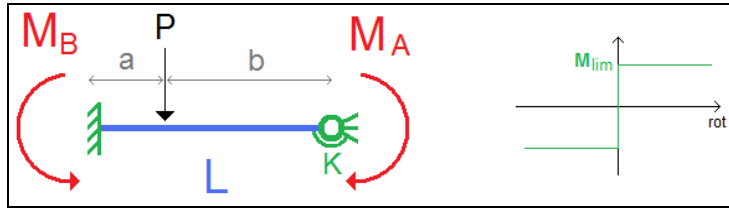


CURAN: BEAMS (HERMITIAN)	TEST 024	rev.1 21/10/13	version 10.70
VALIDATION, CROSS CHECKS, RELIABILITY, BENCHMARK	Tested by: Marco Croci - Checked by: Paolo Rugarli		

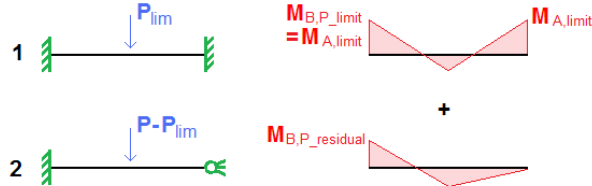


MODEL		
MODEL NAME	OUTPUT FILE	ANALYSIS TYPE
curanBE_024.WSR	curanBE_024.CS1.EEN	nonlinear static (Curan)

DATA							
L [mm]	P [N]	a [mm]	b [mm]	E [N/mm ²]	I [mm ⁴]	K [Nmm/rad]	M _{limit} [Nmm]
1000	1000	500	500	210000	6.667E+03	∞	4.000E+04

THEORETICAL COMPUTATION

Beam material is linear elastic (fibers are not modeled).
 It is possible to consider the sum of 2 schemes:
 1) end **A** fixed - end **B** fixed until M_A reaches the limit value.
 2) end **A** hinge - end **B** fixed for the residual force $P_{residual}=P-P_{limit}$, where P_{limit} is the force giving $M_A=M_{limit}$.



To get moment values with P_{limit} , it is possible to compute the scheme (1) considering an indefinitely linear elastic spring and the full load P: the ratio between P_{limit} and P is equal to the ratio between M_{limit} and $M_{A,linear}$.

$$M_{A,linear} = \frac{PL}{8} \qquad P_{limit} = P \frac{M_{A,limit}}{M_{A,linear}}$$

$$M_{B,linear} = M_{A,linear} \qquad M_{B,P_{limit}} = M_{A,limit}$$

$$M_{B,residual} = \frac{3(P_{residual})L}{16} \qquad M_{B,total} = M_{B,P_{limit}} + M_{B,residual}$$

CROSS-CHECK

End Moment	Theory [Nmm]	Sargon [Nmm]	% difference (S-T)/T*100
$M_A=M_{limit}$	4.000E+04	4.000E+04	0.0
$M_B=M_{B,total}$	1.675E+05	1.675E+05	0.0

NOTES

- L force is parallel to web (strong axis bending).
- $r_i=0$: hinge; $r_i=1$: fixed.
- shear area: not considered. Beam elements number: 2