力学与航空航天工程系
DEPARTMENT OF MECHANICS AND AEROSPACE ENGINEERING

Deadline: 23:00pm of next Monday (2022/03/07)
Please send your homework into TA's mailbox: 12132430@mail.sustech.edu.cn.

MECHANICS OF MATERIALS

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Vocabulary

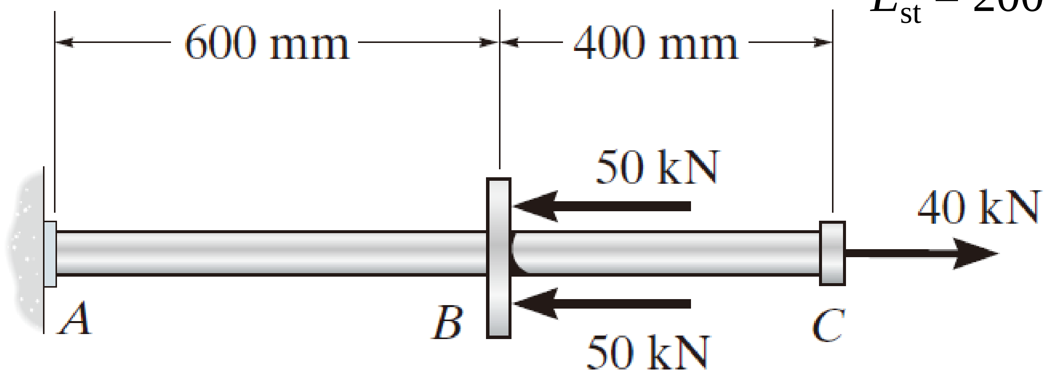
- Elastic (弹性的)
- Plastic （塑性的）
- Indeterminate （非静定的）
- Moment （弯矩）
- Stress（应力）
- Strain （应变）
- Modulus of elasticity (弹性模量)
- Saint Venant’s principle (圣维南原理)
- Resultant （合力）
- Fracture （断裂）
- Yield （屈服）
- Ductile（软的）
- Fatigue （疲劳）
- Dilation（膨胀）
- Compatibility （协调性）
- Poisson （泊松）
- Resilience （弹性恢复）
- Elastoplastic （弹塑性）
- Strain hardening (应变硬化)

Homework-II (7 problems)

Problem 1

F4–1. The 20-mm-diameter A-36 steel rod is subjected to the axial forces shown. Determine the displacement of end *C* with respect to the fixed support at *A*.

E_{st} = 200 GPa

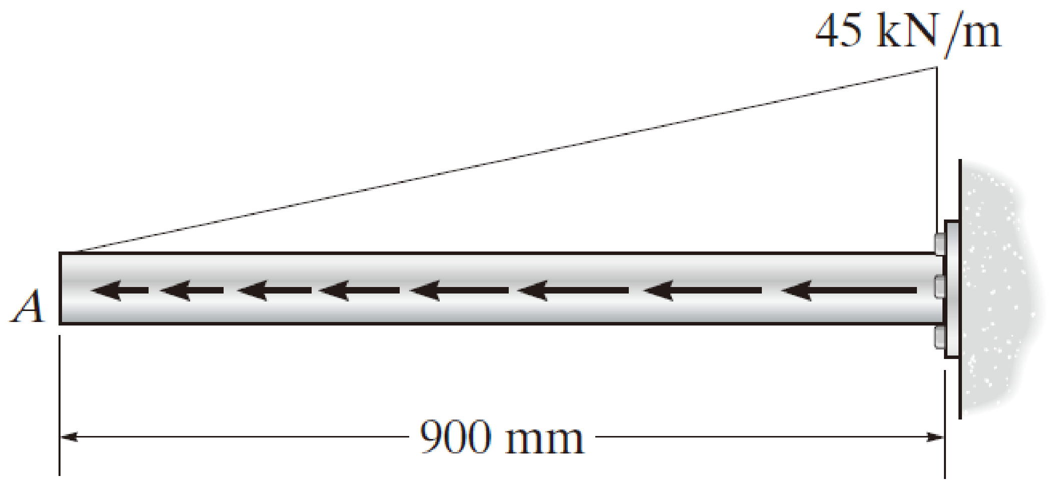


Homework-II (7 problems)

Problem 2

F4–6. The 20-mm-diameter 2014-T6 aluminum rod is subjected to the triangular distributed axial load. Determine the displacement of end A.

E_{st} = 73.1 GPa

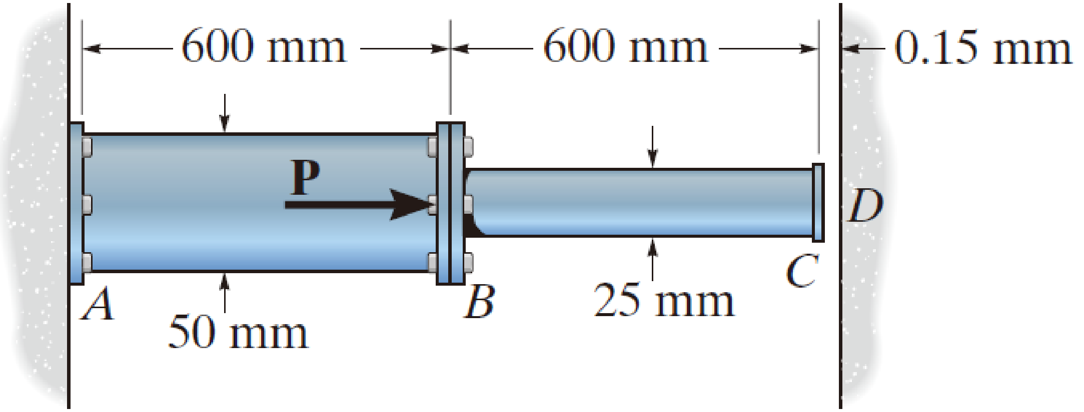


Homework-II (7 problems)

Problem 3

4–46. If the gap between C and the rigid wall at D is initially 0.15 mm, determine the support reactions at A and D when the force $P = 200$ kN is applied. The assembly is made of solid A-36 steel cylinders.

$E_{st} = 200$ GPa



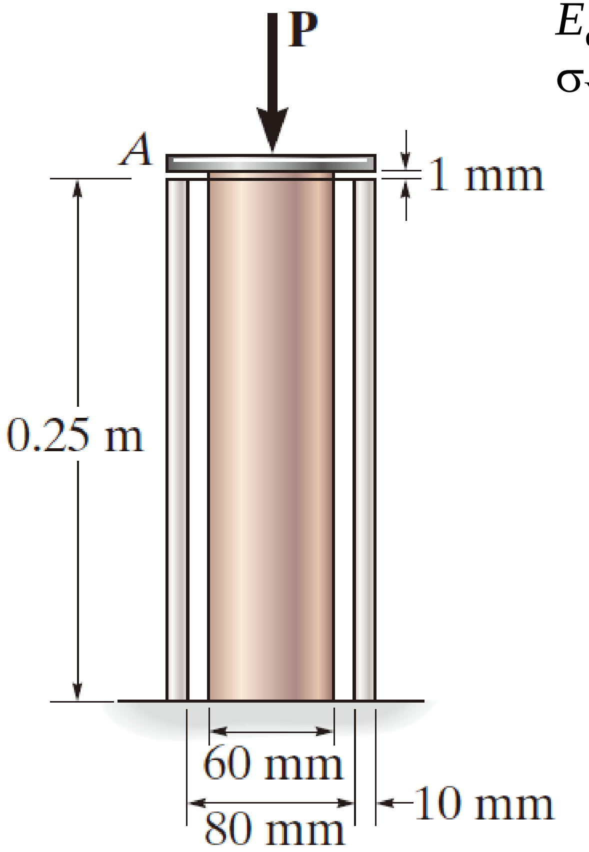
Prob. 4–46

Homework-II

Problem 4

4–47. The support consists of a solid red brass C83400 copper post surrounded by a 304 stainless steel tube. Before the load is applied the gap between these two parts is 1 mm. Given the dimensions shown, determine the greatest axial load that can be applied to the rigid cap *A* without causing yielding of any one of the materials.

E_{co} = 101 Gpa
σ_Y= 70 MPa

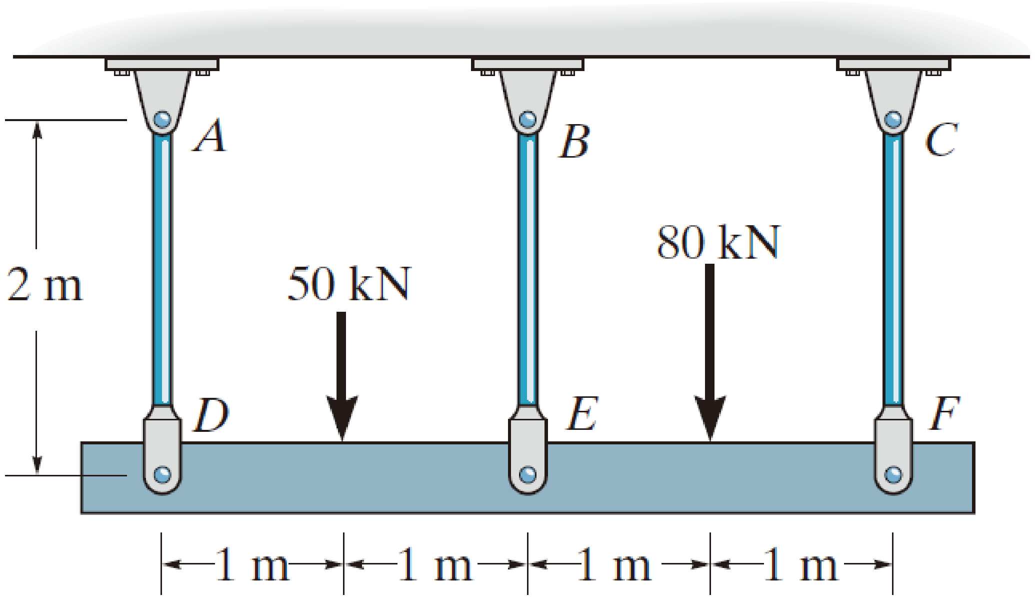


Homework-II (7 problems)

Problem 5

4–55. The three suspender bars are made of A992 steel and have equal cross-sectional areas of 450 mm^2. Determine the average normal stress in each bar if the rigid beam is subjected to the loading shown.

$E_{st} = 200$ GPa



Homework-II (7 problems)

Problem 6

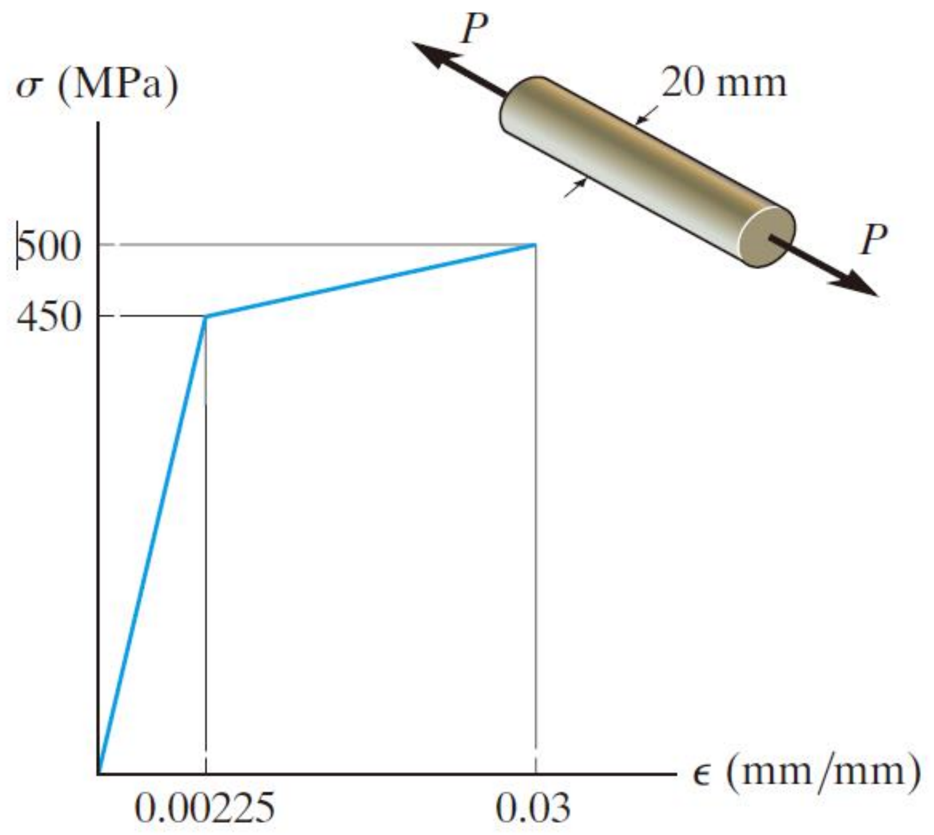
10–33. A rod has a radius of 10 mm. If it is subjected to an axial load of 15 N such that the axial strain in the rod is $\epsilon_x = 2.75(10^{-6})$, determine the modulus of elasticity E and the change in the rod's diameter. $\nu = 0.23$.

Homework-I

Problem 7

F3–11. The material for the 50-mm-long specimen has the stress–strain diagram shown. If $P = 150$ kN is applied and then released, determine the permanent elongation of the specimen.

$E_{st} = 200$ GPa



Average Mechanical Properties of Typical Engineering Materials[a]

(SI Units)

Materials		Density ρ (Mg/m^3)	Moduls of Elasticity E (GPa)	Modulus of Rigidity G (GPa)	Yield Strength (MPa) σ_Y			Ultimate Strength (MPa) σ_u			% Elongation in 50 mm specimen	Poisson's Ratio ν	Coef. of Therm. Expansion α $(10^{-6})/°C$
					Tens.	Comp.[b]	Shear	Tens.	Comp.[b]	Shear			
Metallic													
Aluminum Wrought Alloys	2014-T6	2.79	73.1	27	414	414	172	469	469	290	10	0.35	23
	6061-T6	2.71	68.9	26	255	255	131	290	290	186	12	0.35	24
Cast Iron Alloys	Gray ASTM 20	7.19	67.0	27	–	–	–	179	669	–	0.6	0.28	12
	Malleable ASTM A-197	7.28	172	68	–	–	–	276	572	–	5	0.28	12
Copper Alloys	Red Brass C83400	8.74	101	37	70.0	70.0	–	241	241	–	35	0.35	18
	Bronze C86100	8.83	103	38	345	345	–	655	655	–	20	0.34	17
Magnesium Alloy	[Am 1004-T61]	1.83	44.7	18	152	152	–	276	276	152	1	0.30	26
Steel Alloys	Structural A-36	7.85	200	75	250	250	–	400	400	–	30	0.32	12
	Structural A992	7.85	200	75	345	345	–	450	450	–	30	0.32	12
	Stainless 304	7.86	193	75	207	207	–	517	517	–	40	0.27	17
	Tool L2	8.16	200	75	703	703	–	800	800	–	22	0.32	12
Titanium Alloy	[Ti-6Al-4V]	4.43	120	44	924	924	–	1,000	1,000	–	16	0.36	9.4
Nonmetallic													
Concrete	Low Strength	2.38	22.1	–	–	–	12	–	–	–	–	0.15	11
	High Strength	2.37	29.0	–	–	–	38	–	–	–	–	0.15	11
Plastic Reinforced	Kevlar 49	1.45	131	–	–	–	–	717	483	20.3	2.8	0.34	–
	30% Glass	1.45	72.4	–	–	–	–	90	131	–	–	0.34	–
Wood Select Structural Grade	Douglas Fir	0.47	13.1	–	–	–	–	2.1[c]	26[d]	6.2[d]	–	0.29[e]	–
	White Spruce	3.60	9.65	–	–	–	–	2.5[c]	36[d]	6.7[d]	–	0.31[e]	–

[a] Specific values may vary for a particular material due to alloy or mineral composition,mechanical working of the specimen,or heat treatment. For a more exact value reference books for the material should be consulted.

[b] The yield and ultimate strengths for ductile materials can be assumed equal for both tension and compression.

[c] Measured perpendicular to the grain.

[d] Measured parallel to the grain.

[e] Deformation measured perpendicular to the grain when the load is applied along the grain.