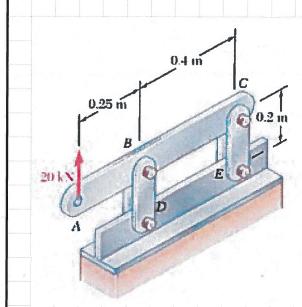
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Topic <u>EXAMPLE</u> STRESS PROBLEM

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## PROBLEM 1.27

For the assembly and loading of Prob. 1.7, determine (a) the average shearing stress in the pin at B, (b) the average bearing stress at B in member BD, (c) the average bearing stress at B in member ABC, knowing that this member has a 10 × 50-mm uniform rectangular cross section.

PROBLEM 1.7 Each of the four vertical links has an 8 × 36-mm uniform rectangular cross section and each of the four pins has a 16-mm diameter. Determine the maximum value of the average normal stress in the links connecting (a) points B and D, (b) points C and E.

Start with statics to determine the force in the pin at B. Recognize links BD & CE are two-force members. 20KN  $\xi'M_{c} = 0;$   $R_{B}(0.4^{m}) - 20^{kN}(0.65^{m}) = 0$ FBDABC  $R_B = 32.5 \text{ kN}$   $E'M_B = 0; -20 \text{ kN} (0.25 \text{ m}) + R_c (0.4 \text{ m}) = 0$ 0.4 m 0.25m

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FBD Pin B	6.25 kN    6.25 kN	6.25 KN 6.25 KN	Outline of bar ABC  C :N
FBD link BD (one link only)	16.25 km	FBD link CE  6.25 KN	nk(s) CE
	φ 16.25 <sup>kN</sup>	6.25 kW	

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2) SHEAR STRESS IN PIN B	
Failed Pin FBD.	
6.25kN  6.25kN	a) So each shear plane must carry 16.25 KN
	$J = \frac{P}{A} = \frac{16.25  \epsilon 3}{201.06  \text{mm}^2} = \frac{80.82  \text{MPe}}{201.06  \text{mm}^2}$
	J A 201,06 mm²
( ( ( ( ( ( ( ( ( ( ( ( ( ( ( ( ( ( (	
16.25kN \$ 16.25kN	b) or, you can recognize the pin is in double shear (i.e. 2 shear planes to seperate the free body) and use:
	$\gamma = \frac{P}{2A} = \frac{32.5 \in 3.^{N}}{2 (201.06 \text{ mm}^{2})} = \frac{80.82 \text{ Mpa}}{80.82 \text{ Mpa}}$
3 <sub>2.5</sub> kN	2A 2 (201.06 mm²)
$A_{pin} = \frac{11}{4} (16^{mm})^2 = 201.06 \text{ mm}^2$	

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3) NORMAL STRESS IN LINK BD	(AWAY FROM HOLES)		
from Free body; link BP mest	carry 16.25 kN		
$\sigma = \frac{1}{A} = \frac{10.23  \text{Comm}}{(\text{Gemm})(\text{Gemm})}$	= 56.42 / Pa (Tensio	n)	
2 / 50		*	
4) NORMAL STRESS IN LINK A	T PIN B		
0 = 16.25 F3 N	- 101.56 MPa	(Tension)	
(8 mm) (36 mm - 16 mm			
+link Wlink	dpin		
5) BEARING STRESS IN LINK AT	PIN B		
This is the stress between the 1	ain & the link.		
1(25)	A IC35 KN	rectangular, green	
	0 10.25	projectea	
4	from Free body; link BP must $O = \frac{P}{A} = \frac{[6.25  \text{f} 3]^{N}}{(8^{mm})(36^{mm})}$ NORMAL STRESS IN LINK A $O = \frac{[6.25  \text{f} 3]^{N}}{(8^{mm})(36^{mm} - [6^{mm})(36^{mm} - [6^{mm})(36^{mm})(36^{mm} - [6^{mm})(36^{mm} - [6^{mm})(36^{mm})(36^{mm} - [6^{mm})(36^{mm})(36^{mm} - [6^{mm})(36^{mm})(36^{mm})(36^{mm})(36^{mm})(36^{mm} - [6^{mm})(36^{m$	NORMAL STRESS IN LINK AT PIN B $ \sigma = \frac{16.25  \epsilon_3}{(8  \text{mm})(36  \text{mm} - 16  \text{mm})} = \frac{101.56  \text{MPa}}{(8  \text{mm})(36  \text{mm})(36  \text{mm})} = \frac{101.56  \text{MPa}}{(8  \text{mm})(36  \text{mm})(36  \text{mm})} = 101.56$	from free body, link BP moust carry $ 6.25 \text{ kN} $ $O = \frac{P}{A} = \frac{[6.25 \in 3]}{(8^{\text{hrm}})(36^{\text{hrm}})} = \frac{56.42 \text{ Mpg}}{(8^{\text{hrm}})(36^{\text{hrm}})} = \frac{101.56 \text{ Mpg}}{(8^{\text{hrm}})(36^{\text{hrm}})} = 101.56$

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a) 50,	bearing = $\frac{16.25 \in 3}{(16 \text{ mm})(8 \text{ mm})} =$ dipin think	126.95 MPa	(Bearing is Compre	ssion)			
b) Or, you co	of pin tlink an recognize that the 32	.5 kN force on bar	ABC is shared	by to link	s at	8.	Thus,
	bearing = (2 links) (16 mm) (8 mm)	= 126.95 MPa					
6) BEARING STRE	SS IN BAR ABC AT B	r contact area					
A							
	Contact area	C					

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	$\frac{32.5  \text{F3}^{ \text{N}}}{\text{(10^{ \text{mm}})} (16^{ \text{mm}})} = \frac{203.13}{\text{MPa}}$	
	t bar dpin	
7) TEAR OUT	OF BAR ABC (ASSUMING PIN IS CENTERED)  20th B	
	tear planes	
	50 mm $ \frac{32.5 \in 3^{N}}{\text{tear}} = \frac{32.5 \in 3^{N}}{\text{to mm}} \left(\frac{50 \text{ mm}}{2}\right) \left(2 + \frac{1}{2}\right) \left(2 + \frac{1}{2$	planes)