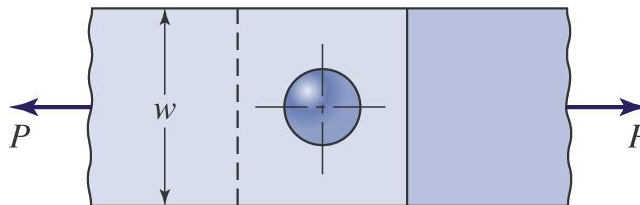
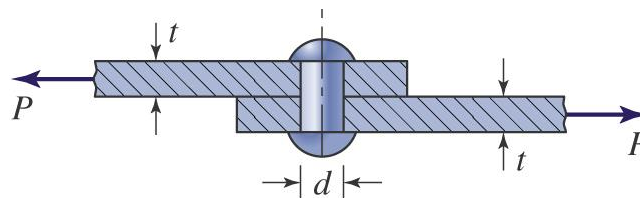


UNIÕES PARAFUSADAS

Prof. Dr. Julio César de Almeida

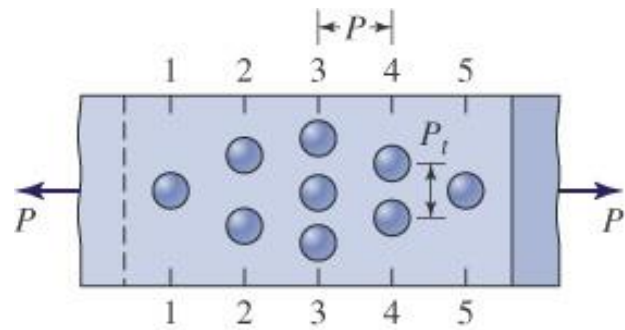
JUNÇÕES CARREGADAS EM CISALHAMENTO

- válido para uniões parafusadas ou rebitadas;
- uma análise global envolve (sem a presença de pré-carga em uniões parafusadas): esmagamento nos parafusos, esmagamento das peças, cisalhamento dos parafusos, cisalhamento da borda das peças e tração nas peças;
- para uniões que mantenham a condição da pré-carga, as parcelas de esmagamento podem ser descartadas.



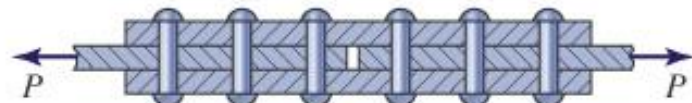
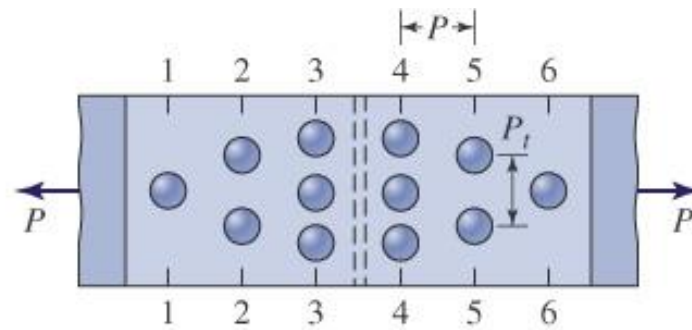
TIPOS DE JUNTAS

Juntas sobrepostas:



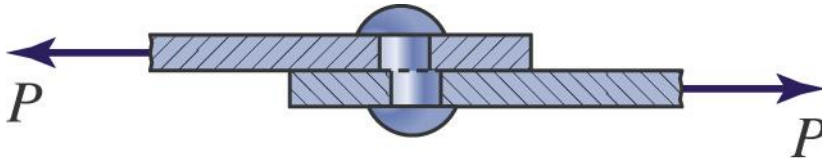
(a)

Juntas de tampo:

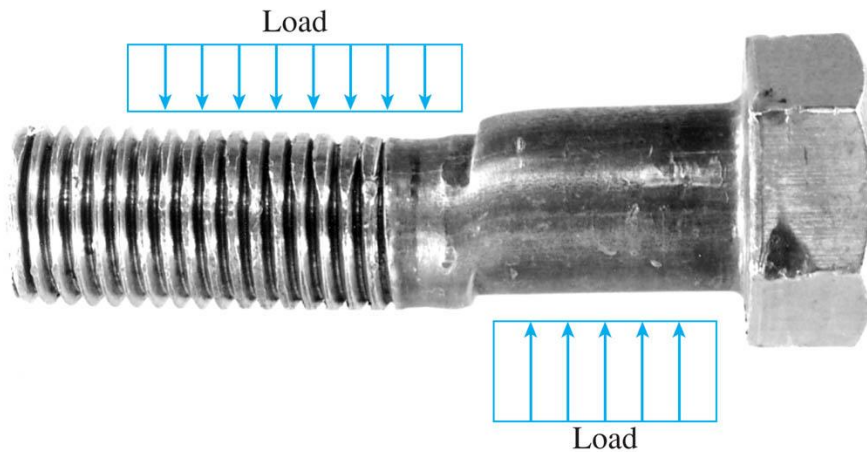


(b)

(a) CISALHAMENTO DOS PARAFUSOS



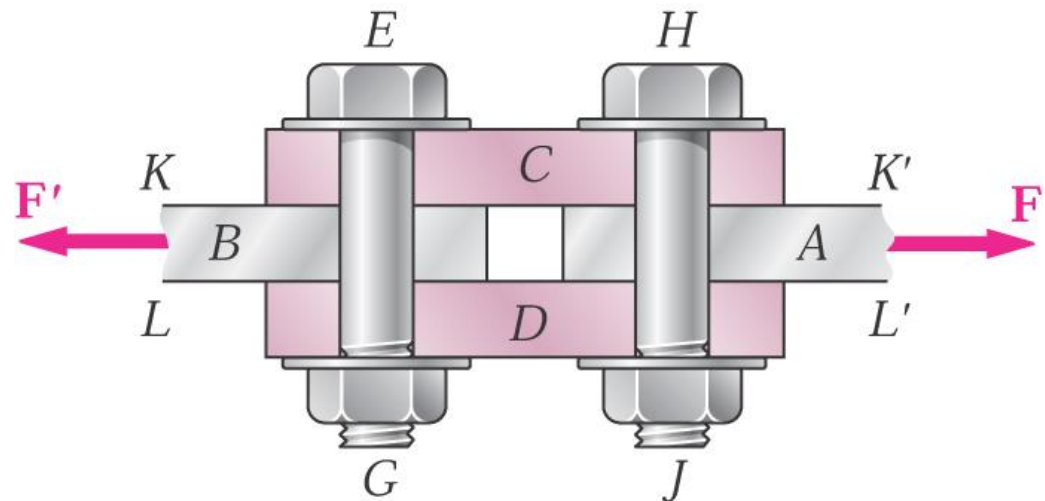
$$\tau = \frac{4.P}{\pi.d^2}$$



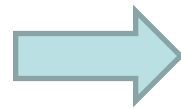
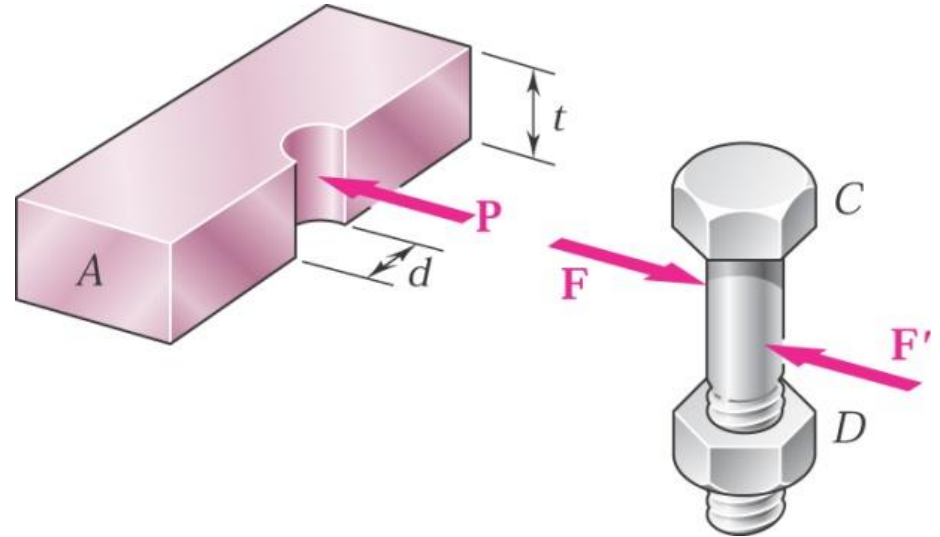
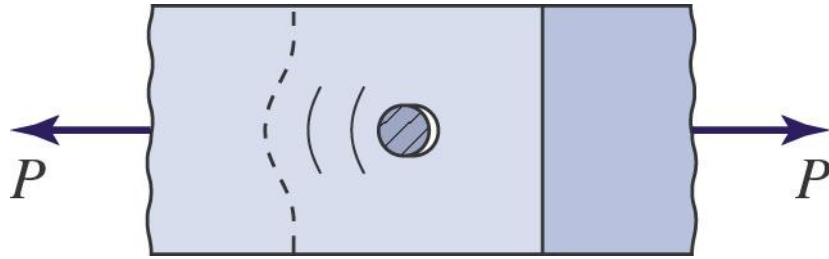
$$P = \tau \frac{\pi.d^2}{4} n$$

(a) CISALHAMENTO DOS PARAFUSOS

- observar o número de secções do parafuso submetidas ao corte (corte simples, corte duplo, etc.)

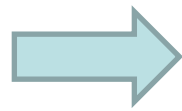
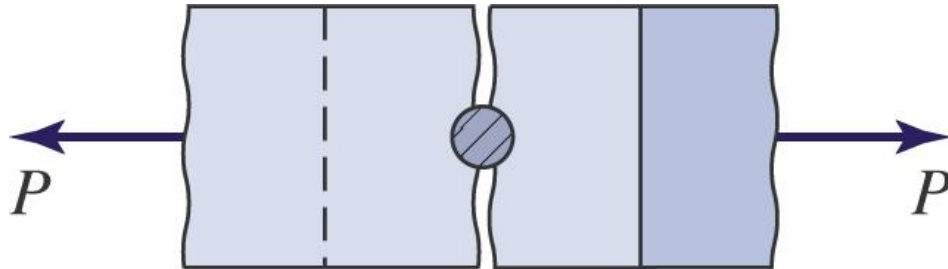


(b) ESMAGAMENTO DAS PEÇAS/PARAFUSOS



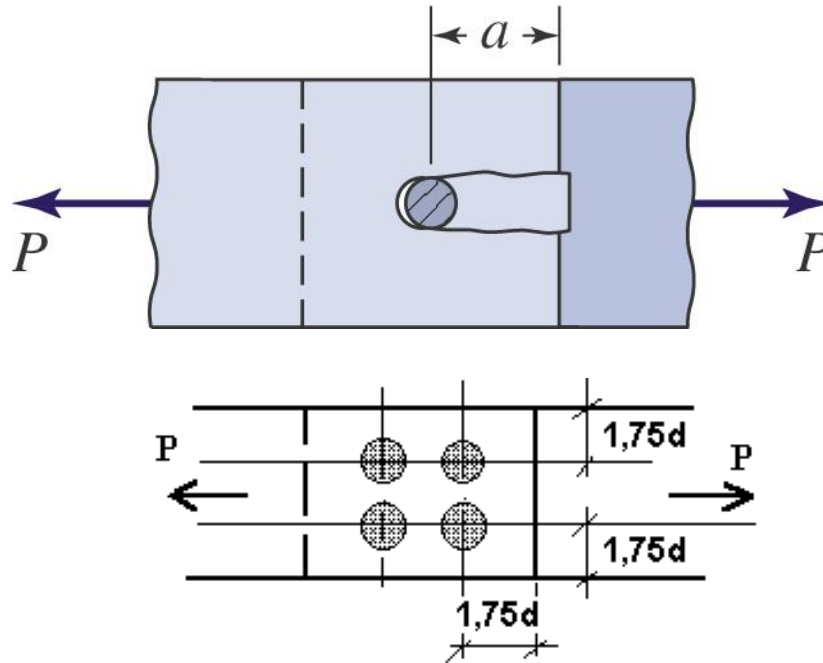
$$P = \overline{\sigma_c} d \cdot t \cdot n$$

(c) TRAÇÃO NAS PEÇAS



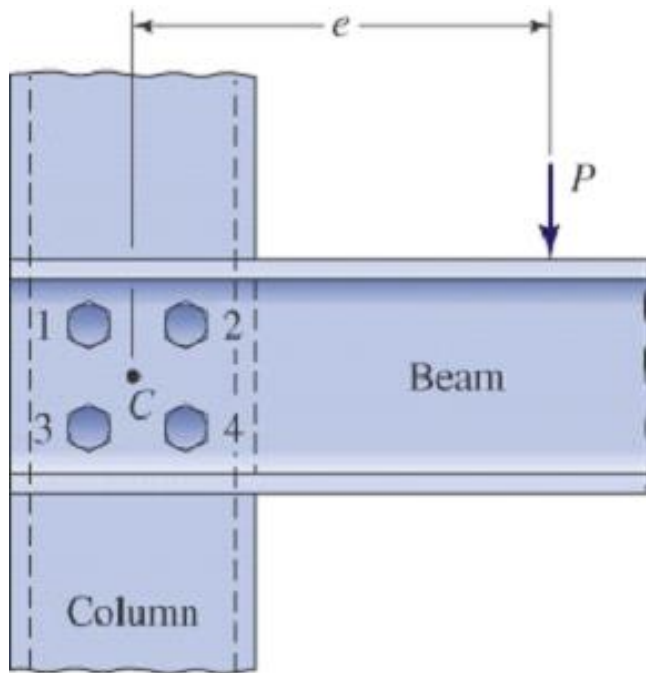
$$P = \overline{\sigma}_t (L - nd).t$$

(d) CISALHAMENTO DA BORDA DAS PEÇAS

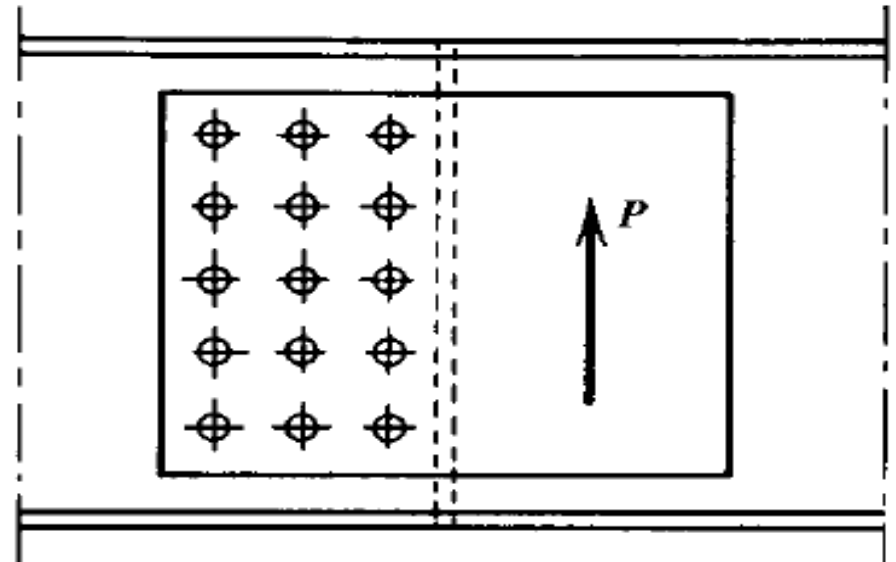


condição : $a > 1,75d$

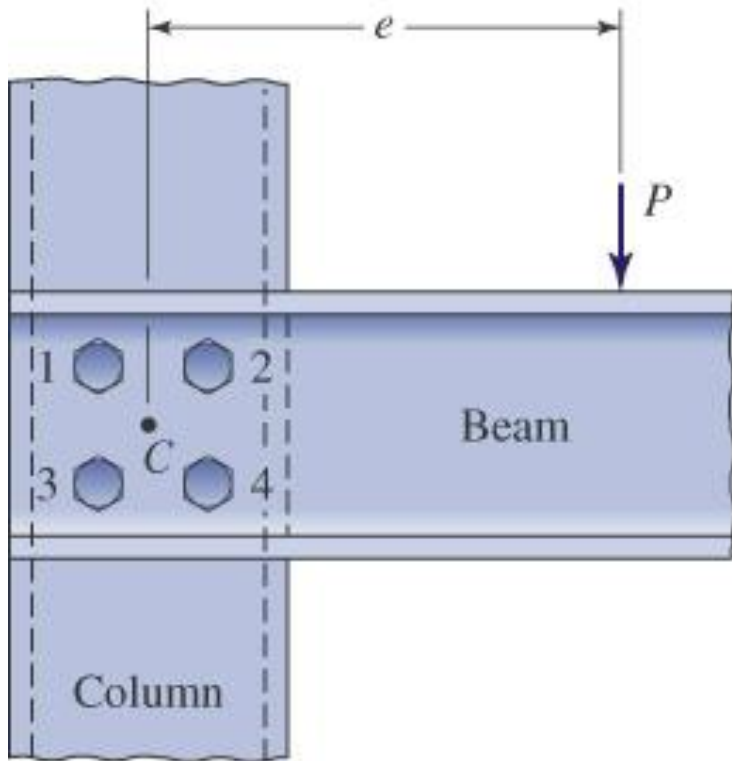
JUNÇÕES DE CISALHAMENTO - EXCÊNTRICAS



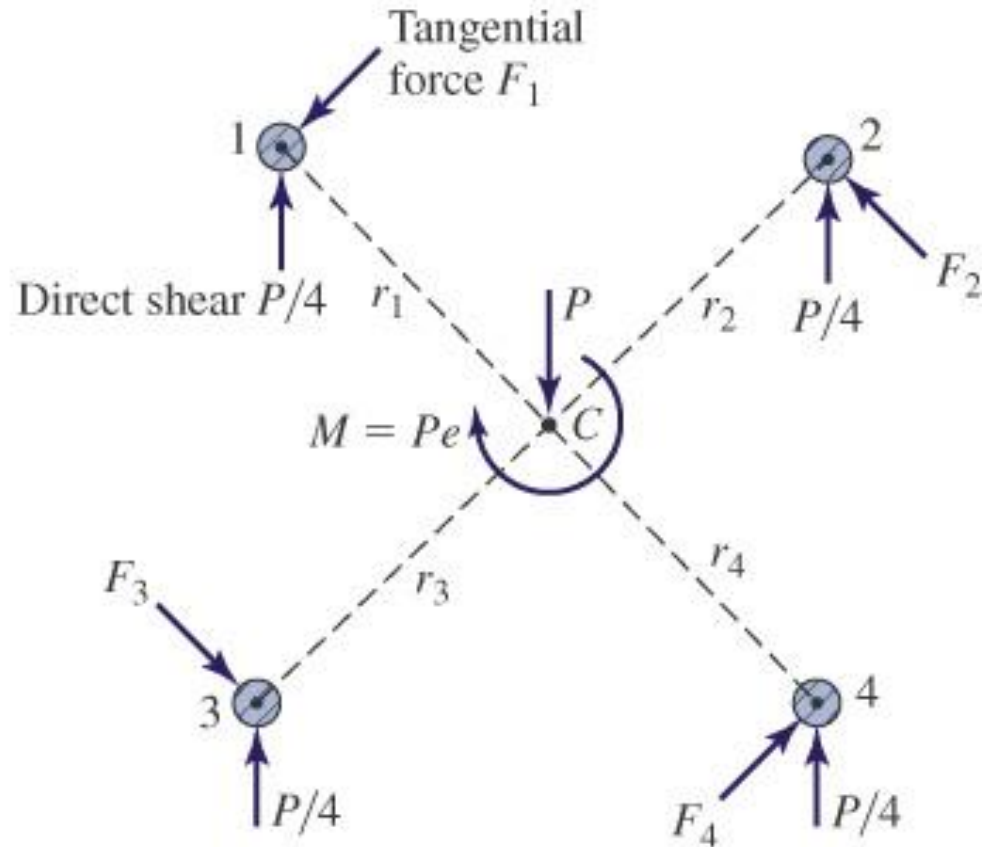
(a)



JUNÇÕES DE CISALHAMENTO - EXCÊNTRICAS



(a)

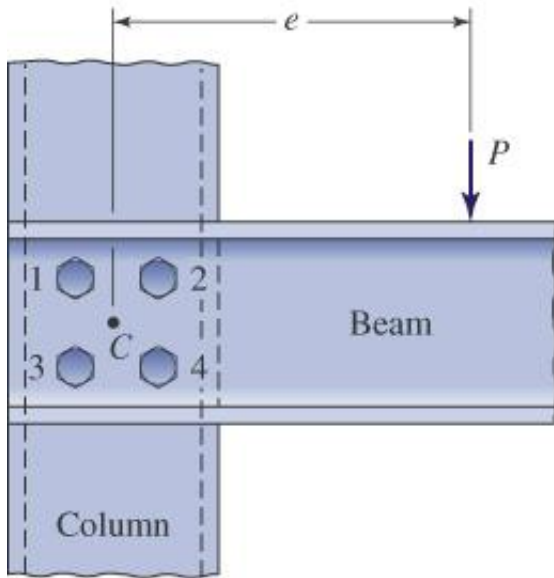


(b)

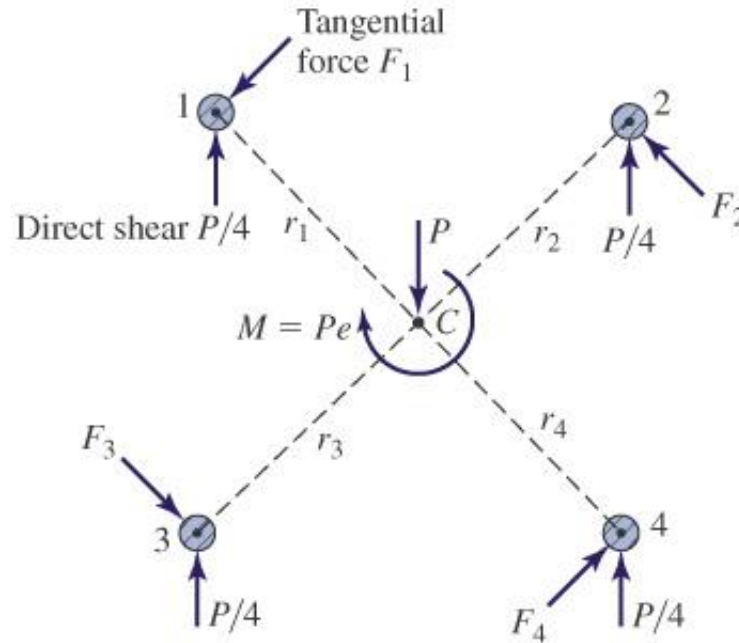
Parcelas de carga:

- Cisalhamento direto (primário);
- Cisalhamento devido ao binário (secundário).

JUNÇÕES DE CISALHAMENTO - EXCÊNTRICAS



(a)



(b)

$$F' = \frac{P}{n}$$

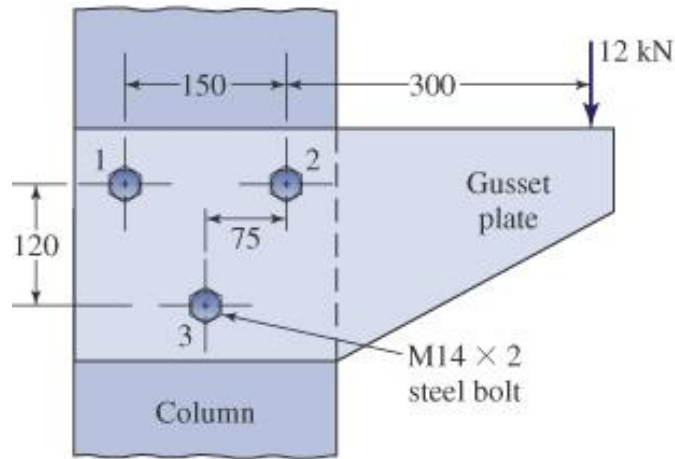
$$M = F_A'' r_A + F_B'' r_B + F_C'' r_C + F_D'' r_D$$

$$\frac{F_A''}{r_A} = \frac{F_B''}{r_B} = \dots = \frac{F_n''}{r_n}$$

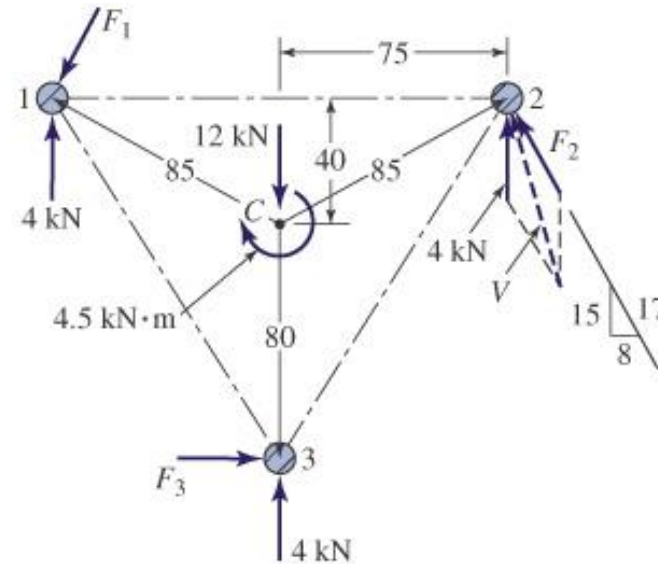
$$M = \frac{F_n''}{r_n} r_A^2 + \frac{F_n''}{r_n} r_B^2 + \dots$$

$$F_n'' = \frac{M r_n}{\sum r_i^2}$$

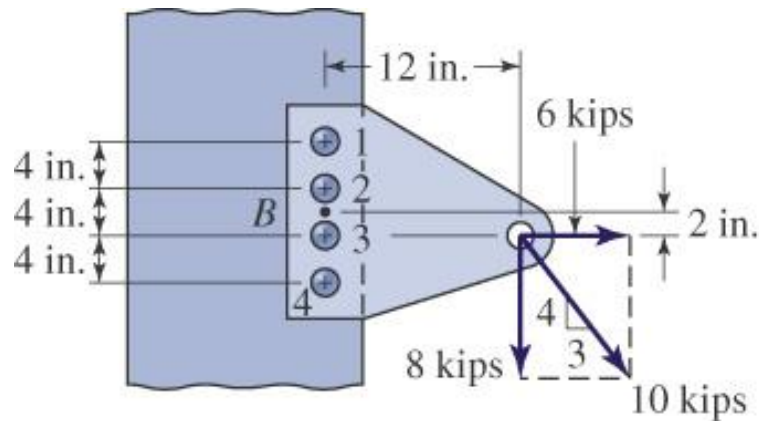
JUNÇÕES DE CISALHAMENTO – EXCÊNTRICAS - EXEMPLOS



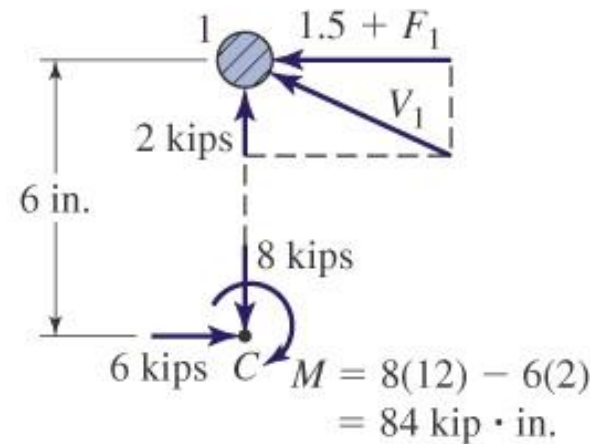
(a)



(b)



(a)



(b)

JUNÇÕES DE CISALHAMENTO - EXCÊNTRICAS

F' – cisalhamento primário

F'' – cisalhamento secundário

M – momento força em relação CG conj.parafusos

r_n – distância do CG conj. ao parafuso em análise

n – número de parafusos da união

$$\vec{\mathbf{R}} = \vec{\mathbf{F}}' + \vec{\mathbf{F}}'' \Rightarrow |\tau_{\mathbf{R}}| \leq \bar{\tau}$$

soma vetorial

BIBLIOGRAFIA DE REFERÊNCIA



- SHIGLEY, MISCHKE e BUDYNAS – Projeto de Engenharia Mecânica, editora Bookman.
- SHIGLEY, Joseph Edward – Mechanical Engineering Design, McGraw-Hill.
- HAMROCK, Bernard J. – Elementos de Máquinas – McGraw-Hill.
- NIEMANN - Elementos de Máquinas, editora Edgard Blucher Ltda.
- PUC-MG – Métodos de Dimensionamento à Fadiga/PPGEM.
- DURAN, Jorge A.R. – Notas de aula de projeto em fadiga – Universidade Federal Fluminense.
- JUVINALL, Robert – Fundamentos do Projeto de Componentes de Máquinas, LTC.
- BEER, Ferdinand & JOHNSTON, Russel. Resistência dos Materiais. - McGraw-Hill.