# Lecture 8.
# DIRECT SHEAR

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# Plan of lecture

- 1. Basis expressions for deformation of shear
- 2. Example

# Basis expressions for deformation of shear

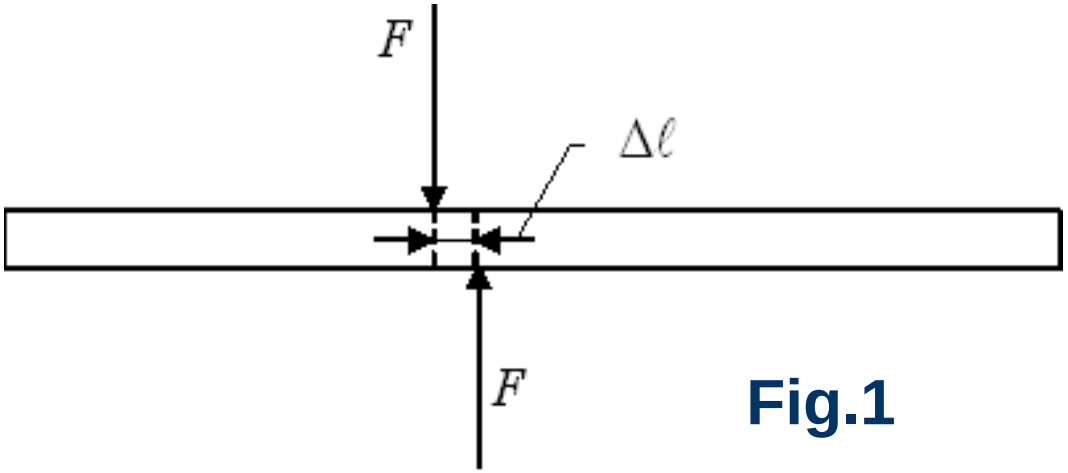



**Fig.1**

**If a plane is passed through a body, a force acting along this plane is called a *shear force* or *shearing force*.**

$$\tau = \frac{Q}{A} \qquad \textbf{(1)}$$

# Basis expressions for deformation of shear

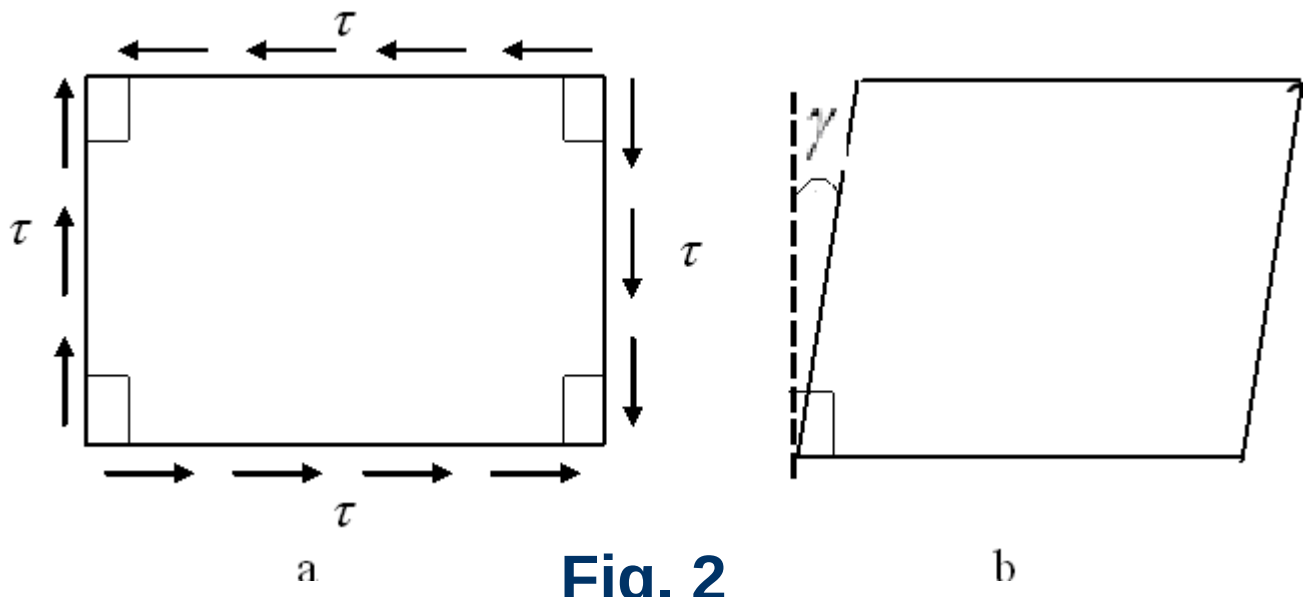



**Fig. 2**

**Hooke's law :** $\tau = G\gamma$ **(2)**

$G$ - ***modulus of elasticity in shear*** ;

$\gamma$ - ***shear strain***

# Basis expressions for deformation of shear

**The expression that shows the connection between the modulus of elasticity in shear and tangent modulus:**

$$G = \frac{E}{2(1+\mu)} \qquad \textbf{(3)}$$

$\mu$ **- Poisson's Ratio**

# Basis expressions for deformation of shear

**The expression which shows the concept about Poisson's Ratio:**

$$\varepsilon_y = -\mu\varepsilon_x \qquad \textbf{(4)}$$

$\varepsilon_y$ **- transverse strain;** $\varepsilon_x$ **- longitudinal strain**

$$\varepsilon_y = -\frac{\Delta a}{a} \; ; \qquad \varepsilon_x = \frac{\Delta \ell}{\ell} \qquad \textbf{(5)}$$

# Basis expressions for deformation of shear

**bolted joint**

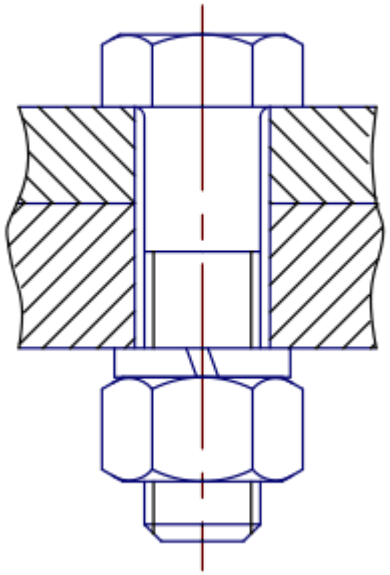


**Fig. 3**

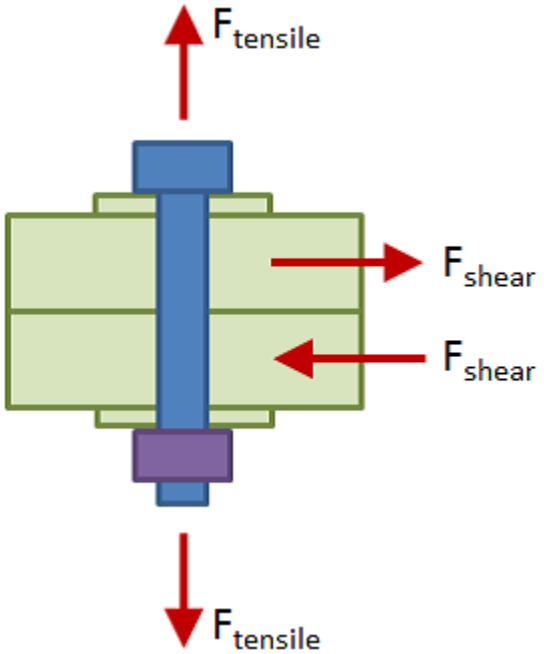



**Fig. 4**

# Basis expressions for deformation of shear

**The condition about strength of shear for bolted joint:**

$$\tau_{\max} = \frac{Q_{\max}}{A} = \frac{4Q_{\max}}{nm\pi d^2} \le [\tau] \qquad \textbf{(6)}$$

**where**

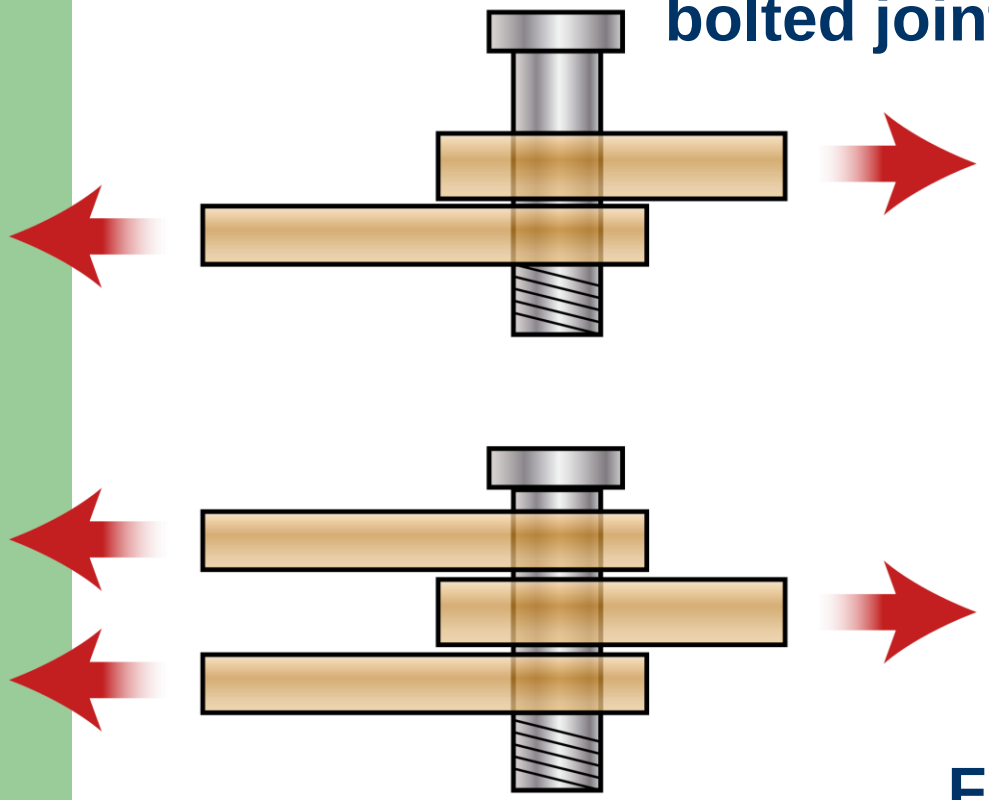
$n$ **- the number of bolt;**

$m$ **- the number of friction planes;**

$d$ **- the diameter of bolt cross-section**

# Basis expressions for deformation of shear

**bolted joints**



$$m = 1$$

$$m = 2$$

**Fig. 5**

# Example

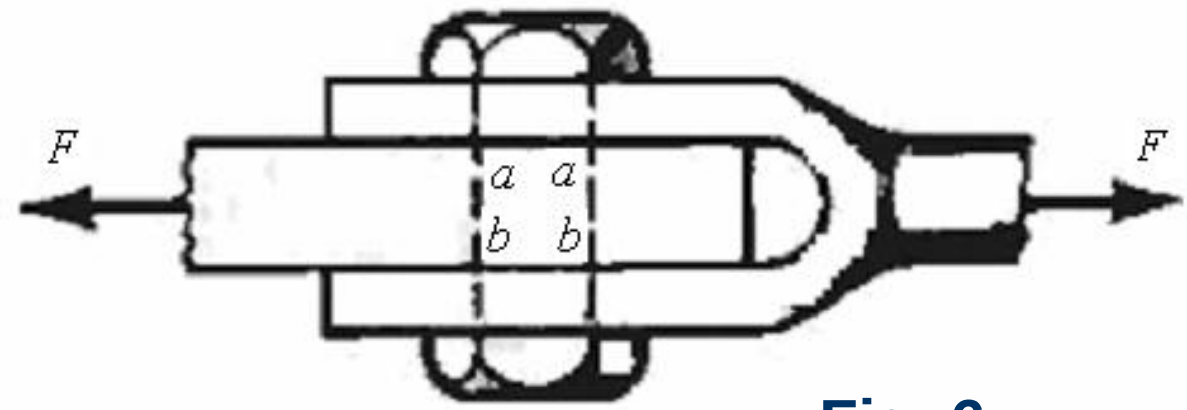



**Fig. 6**

**This is given:**

**F=30 kN; d=10 mm**

**Need to find shearing stress**

Thank you!

Good bye!