SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
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DEPARTMENT OF MECHANICAL ENGINEERING

19MET301 – DESIGN OF MACHINE ELEMENT

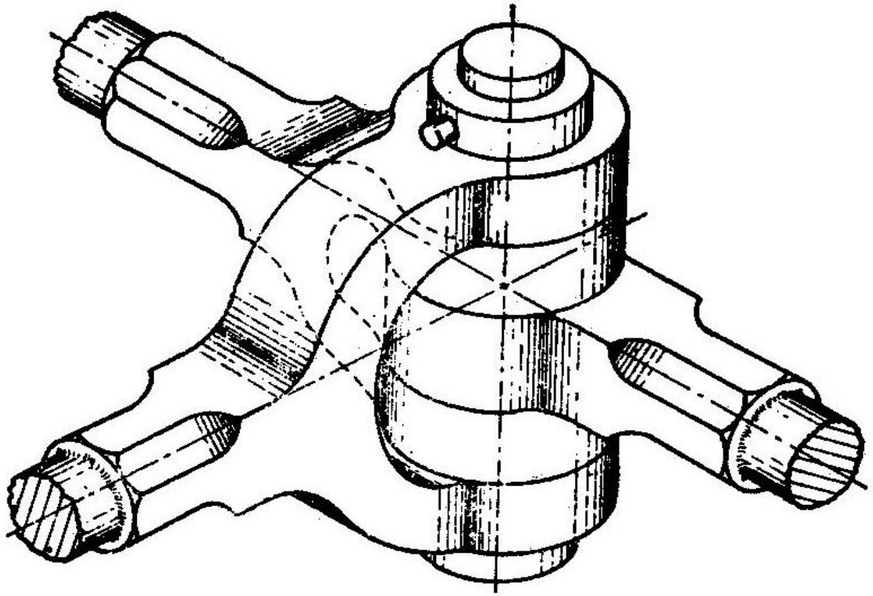
III YEAR VSEM

UNIT 2 – Design of Variable Loading and Joints

TOPIC 3 –Knuckle Joints

Identify the Type of Joints and its Application

Source:Slideshare.net



Knuckle Joints

- Two or more rods subjected to tensile and compressive forces are fastened together.
- Their axes are not in alignments but meet in a point.
- The joint allows a small angular moment of one rod relative to another.
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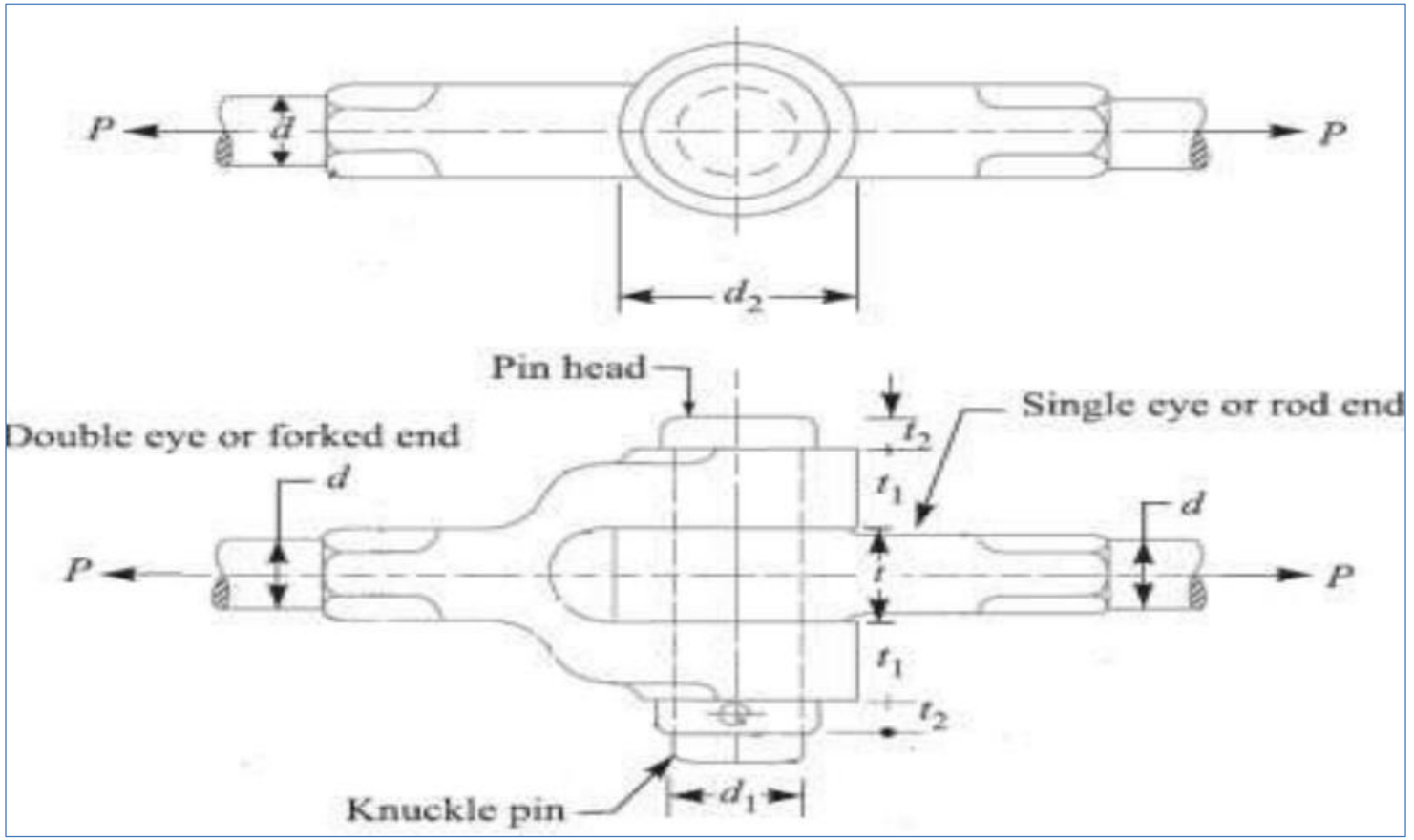
- Applications: Elevator chains, valve rods, etc

Design of Knuckle Joints



Source:Researchgate.com

Knuckle Joints

Design of Knuckle Joints

Let P = Load carried by the rods,

d = Diameter of the rods,

d_p =Diameter of Knuckle Pin

t=Thickness of Single Eye

t_1 =Thickness of Double Eye.

D= Outside diameter of eye

σt = Permissible tensile stress for the rods material

τ = Permissible shear stress for the cotter material

σc = Permissible crushing stress for the cotter material

Diameter of Circular Rod

Parameter to be calculated	Stress Induced	Equation
Diameter of rod (d):	Tensile stress (σ_t)	$\sigma_t = \frac{P}{(\pi d^2/4)}$

Source: Researchgate.com

Knuckle Rod

Diameter of Knuckle Pin

Parameter to be calculated	Stress Induced	Equation
Diameter of knuckle pin (d_p)	Direct shear stress (τ)	$\tau = \frac{P}{[2(\pi {d_p}^2)/4]}$

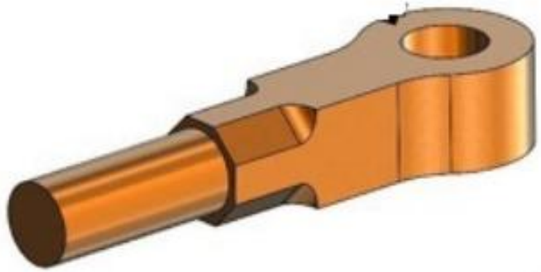
Source:Researchgate.com

Knuckle Pin

Thickness of single eye

Parameter to be calculated	Stress Induced	Equation
Thickness of single eye (t)	(i)Crushing stress(σ_c) or bearing pressure (P_b) (ii)By proportion	$\sigma_c or P_b = \frac{P}{d_p t}$ $t=1.25d$

Source: Researchgate.com

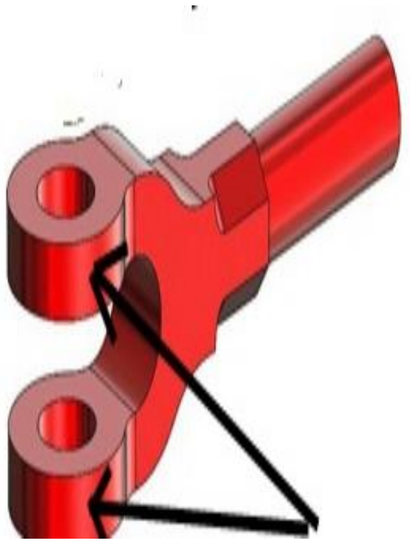


Single Eye

Thickness of fork (t_1)

Parameter to be calculated	Stress Induced	Equation
Thickness of fork (t_1)	(i)Crushing stress(σ_c) or bearing pressure (P_b) (ii)By proportion	$\sigma_c or P_b = \frac{P}{2 d_p t_1}$ $t_1 = 0.75d$

Source:Researchgate.com

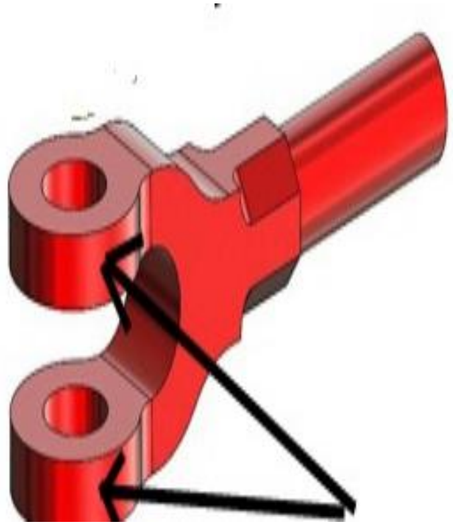


Double Eye

Outside diameter of eye (D)

Parameter to be calculated	Stress Induced	Equation
Outside diameter of eye (D)	(i)Tensile stress(σ_t) (ii)Direct shear stress (τ)	$\sigma_t = \frac{P}{(D - d_p)t}$ $\tau = \frac{P}{(D - d_p)t}$

Source:Researchgate.com

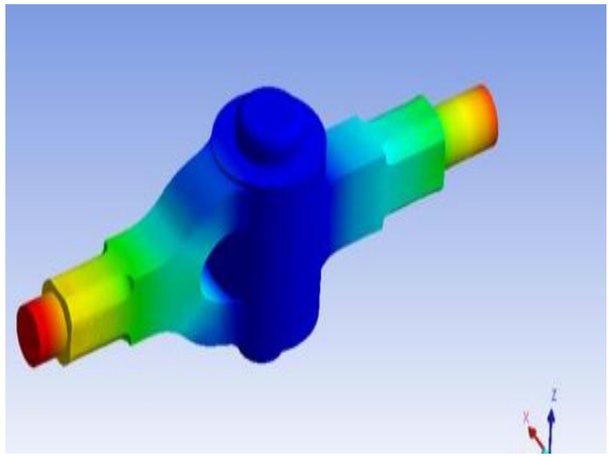


Double Eye

Stress in fork

Parameter to be calculated	Stress Induced	Equation
Stress in fork	(i)Tensile stress(σ_t)	$\sigma_t = \frac{P}{2(D - d_p)t_1}$
	(ii)shear stress (τ)	$\tau = \frac{P}{2(D - d_p)t_1}$

Source:Researchgate.com



Stress Distribution of Knuckle Joints

Assesment-1

Design a knuckle joint to transmit 150 kN. The design stresses may be taken as 75 MPa in tension, 60 MPa in shear and 150 MPa in compression.

References

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