UNIT-4

Topic: Design of Weld Joint

Learning Objectives

- Possible failure mechanisms in welded joints.
- How to design various kinds of welding joints.

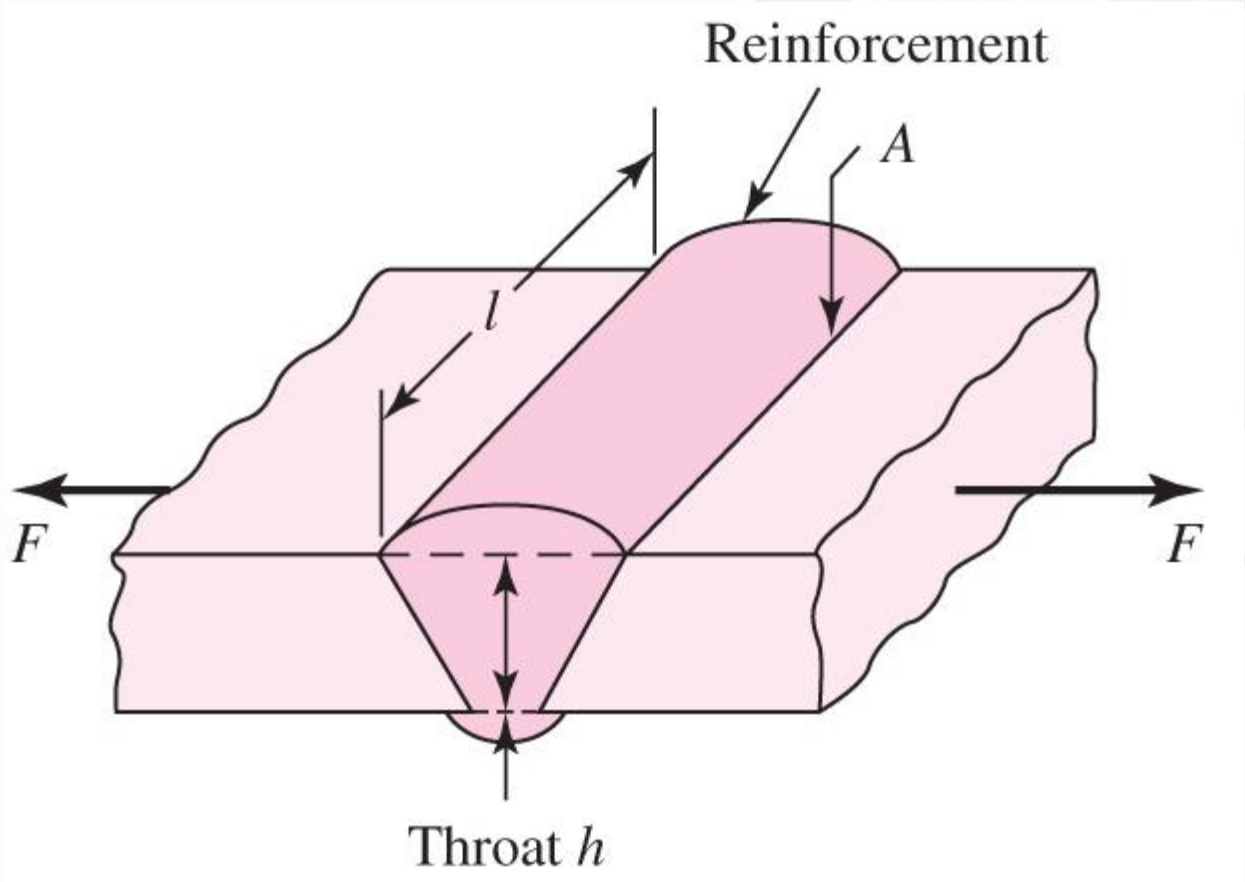
. Design of a butt joint:

- Simple butt joint loaded in tension or compression
- Stress is normal stress

$$\sigma = \frac{F}{hl}$$

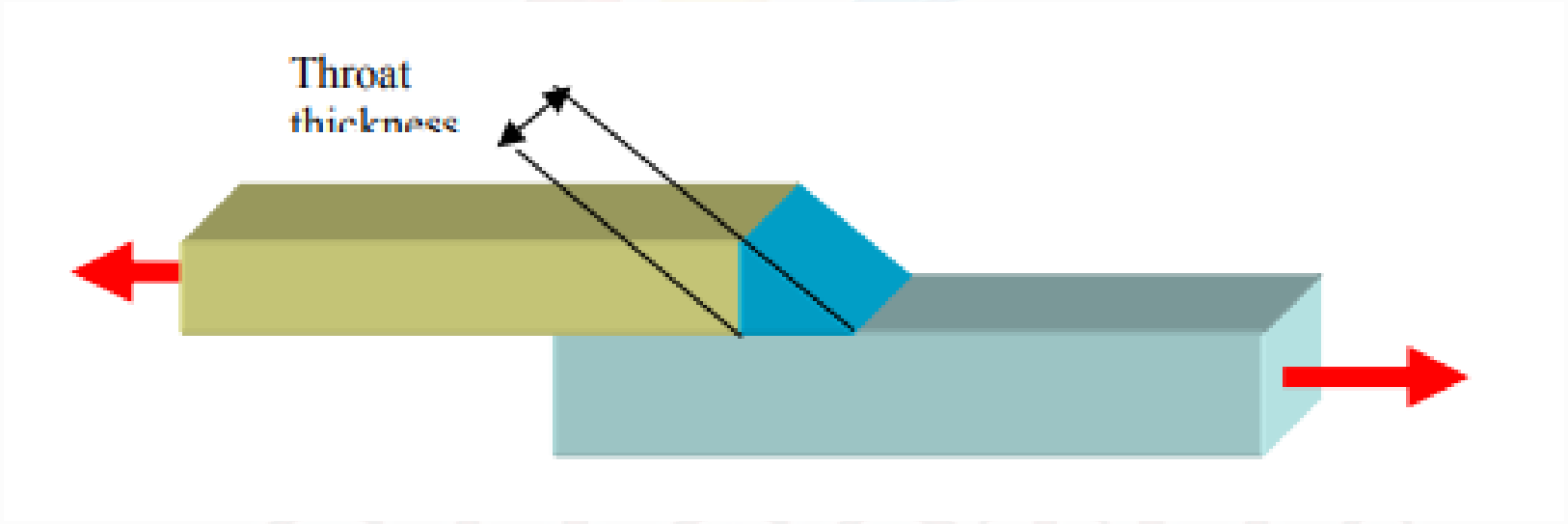
- Throat *h* does not include extra reinforcement
- Reinforcement adds some strength for static loaded joints
- Reinforcement adds stress concentration and should be ground off for fatigue loaded joints

. Design of a butt joint:

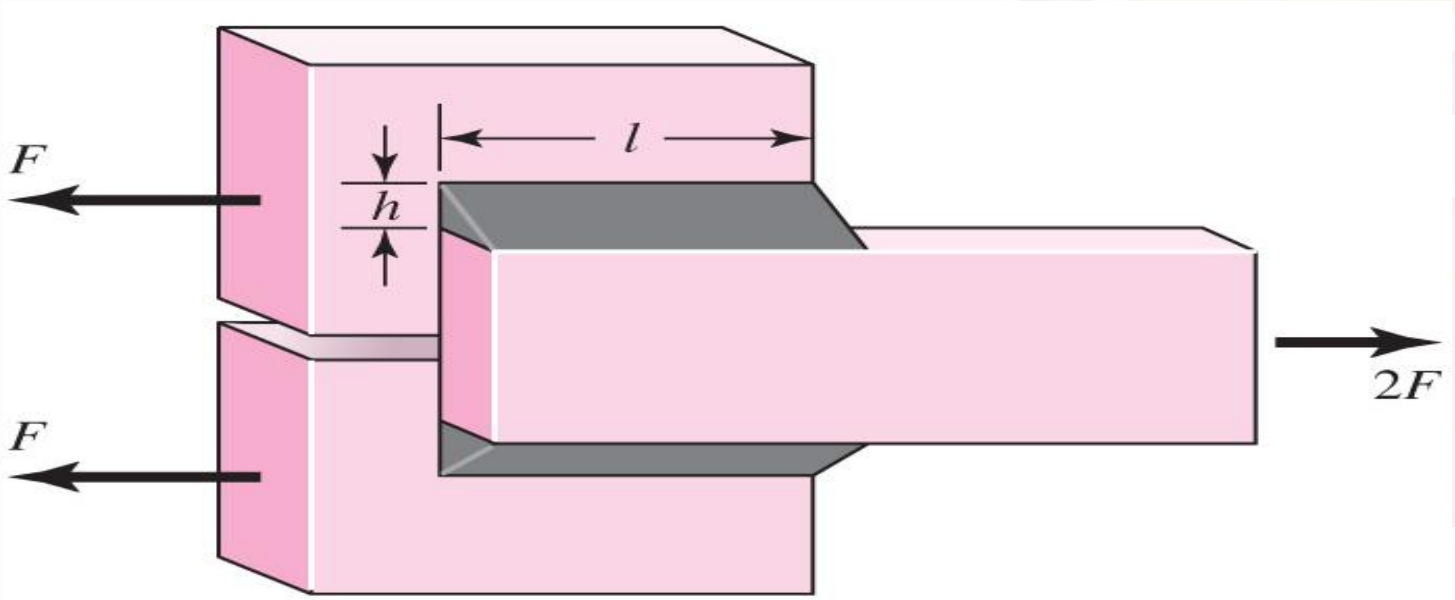


Design of transverse fillet joint:

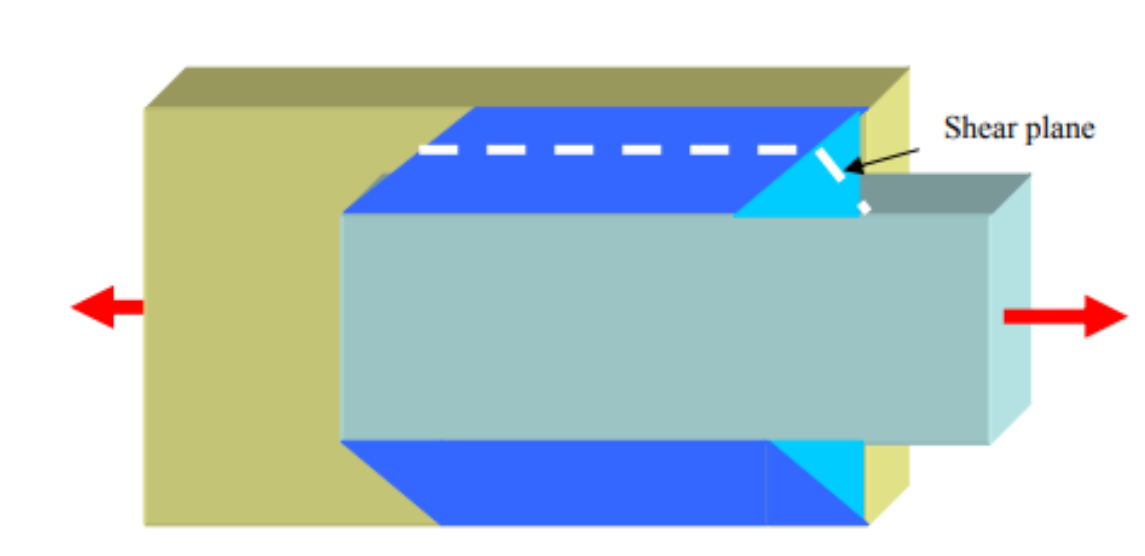
- Consider a single transverse joint as shown in figure
- If the fillet weld has equal base and height then the cross section of the throat is easily seen to be 2 hl . With the above consideration the permissible load carried by a transverse fillet weld is
- $P = S_s A_{throat}$ where
- S_s -allowable shear stress
- A_{throat} =throat area.



Parallel Fillet Welds



Parallel Fillet Welds



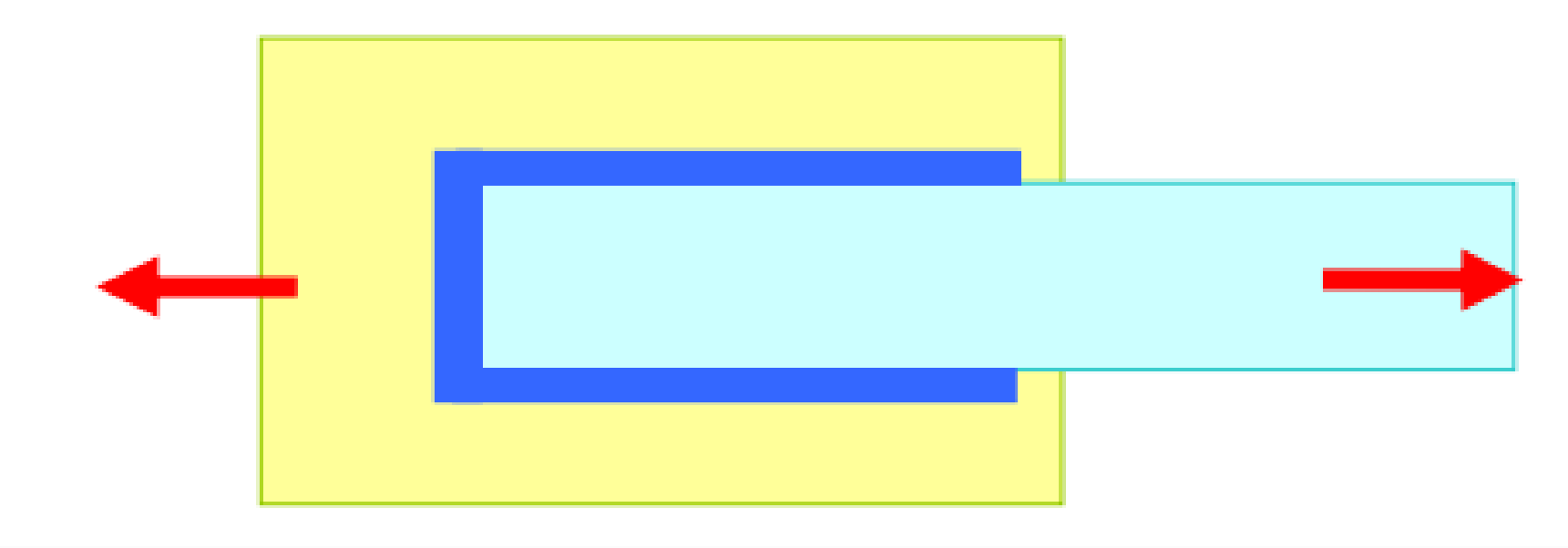
The total allowable load is

$P = 2\ S_s\ A_{throat}$ where

S_s -allowable shear stress

A_{throat} =throat area.

Design of combined transverse and parallel fillet joint



When a combination of transverse and parallel fillet joint is required (see figure) the allowable load is

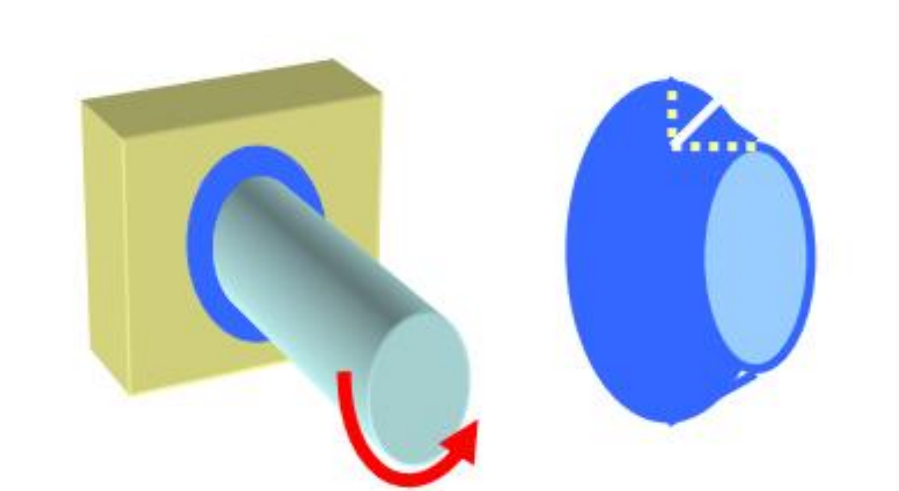
$$P = 2s_s A_t + s_s A_t'$$

where A_t =throat area along the longitudinal direction.

A_t' =throat area along the transverse direction.

Design of circular fillet weld subjected to torsion:

- Consider a circular shaft connected to a plate by means of a fillet joint as shown in figure



- The throat dimension and hence weld dimension can be selected from the equation

$$\frac{2T}{\pi t_{throat} d^2} = s_s$$

Design stresses of welds:

- Determination of stresses in a welded joint is difficult because of
- in homogeneity of the weld joint metals
- thermal stresses in the welds
- changes of physical properties due to high rate of cooling etc.
- The stresses in welded joints for joining ferrous material with MS electrode are tabulated below.

Design stresses of welds:

Type of load		Bare electrodes (Static load)	Covered electrodes (Static load)
Butt weld	Tension (MPa)	91.5	112.5
	Compression (MPa)	105.4	126.5
	Shear (MPa)	56.2	70.3
Fillet weld	Shear (MPa)	79.5	98.5

Questions for Practice:

- A plate 50 mm wide and 12.5 mm thick is to be welded to another plate by means of parallel fillet welds. The plates are subjected to a load of 50 kN. Find the length of the weld. Assume allowable shear strength to be 56 MPa.
- Two plates 200 mm wide and 10 mm thick are to be welded by means of transverse welds at the ends. If the plates are subjected to a load of 70 kN, find the size of the weld assuming the allowable tensile stress 70 MPa.

References

1. https://nptel.ac.in/content/storage2/courses/112105125/pdf/mod10les4.pdf
2. V.B. Bhandari (2010), Design of Machine elements, 3rd Edition, Tata McGraw Hill.ISBN: 978-0-070-68179-8.
3. Richard G. Budynas, J. Keith Nisbet(2011) Shigley's Mechanical Engineering Design ,Ninth Edition, McGRAW-HILL, ISBN: 978-0-07-352928-8

Thank you