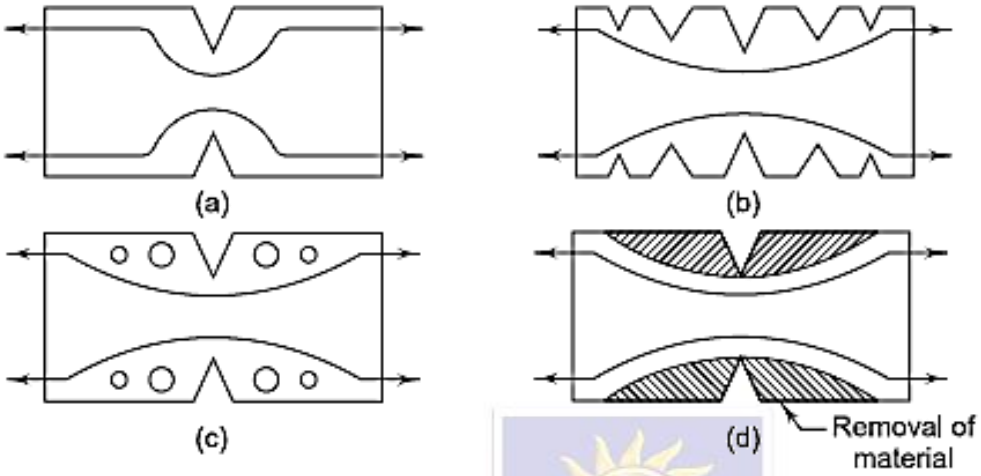

Fig. 5.9 *Reduction of Stress Concentration due to V-notch: (a) Original Notch (b) Multiple Notches (c) Drilled Holes (d) Removal of Undesirable Material*

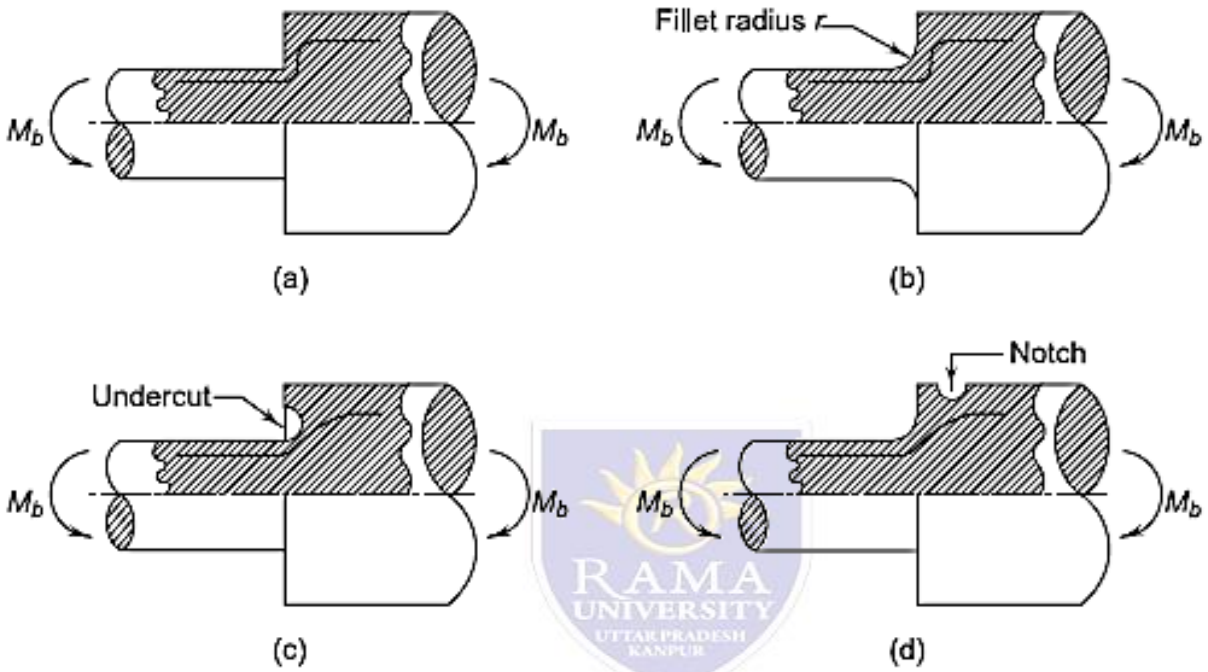

Fig. 5.10 *Reduction of Stress Concentration due to Abrupt Change in Cross-section: (a) Original Component (b) Fillet Radius (c) Undercutting (d) Addition of Notch*

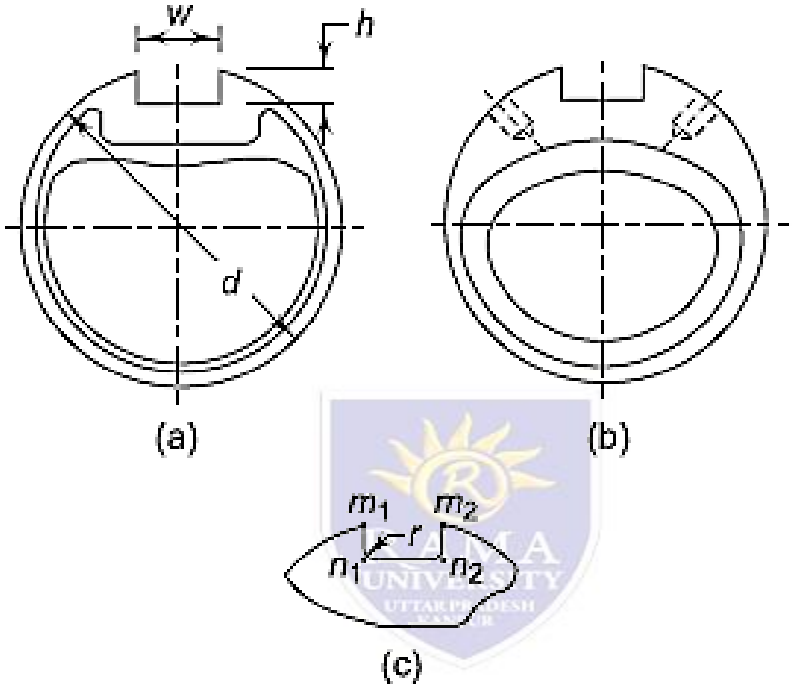

Fig. 5.11 *Reduction of Stress Concentration in Shaft with Keyway: (a) Original Shaft (b) Drilled Holes (c) Fillet Radius*

- FLUCTUATING STRESSES
- In many applications, the components are subjected to forces, which are not static, but vary in magnitude with respect to time. The stresses induced due to such forces are called fl uctuating stres ses.
- It is observed that about 80% of failures of mechanical components are due to 'fatigue failure' resulting from fl uctuating stresses.There are three types of mathematical models for cyclic stresses—fl uctuating or alternating stresses, repeated stresses and reversed stresses
- σmax. and σ min. are maximum and minimumstresses, while σm and σa are called mean stress and stress amplitude respectively. It can be proved that,

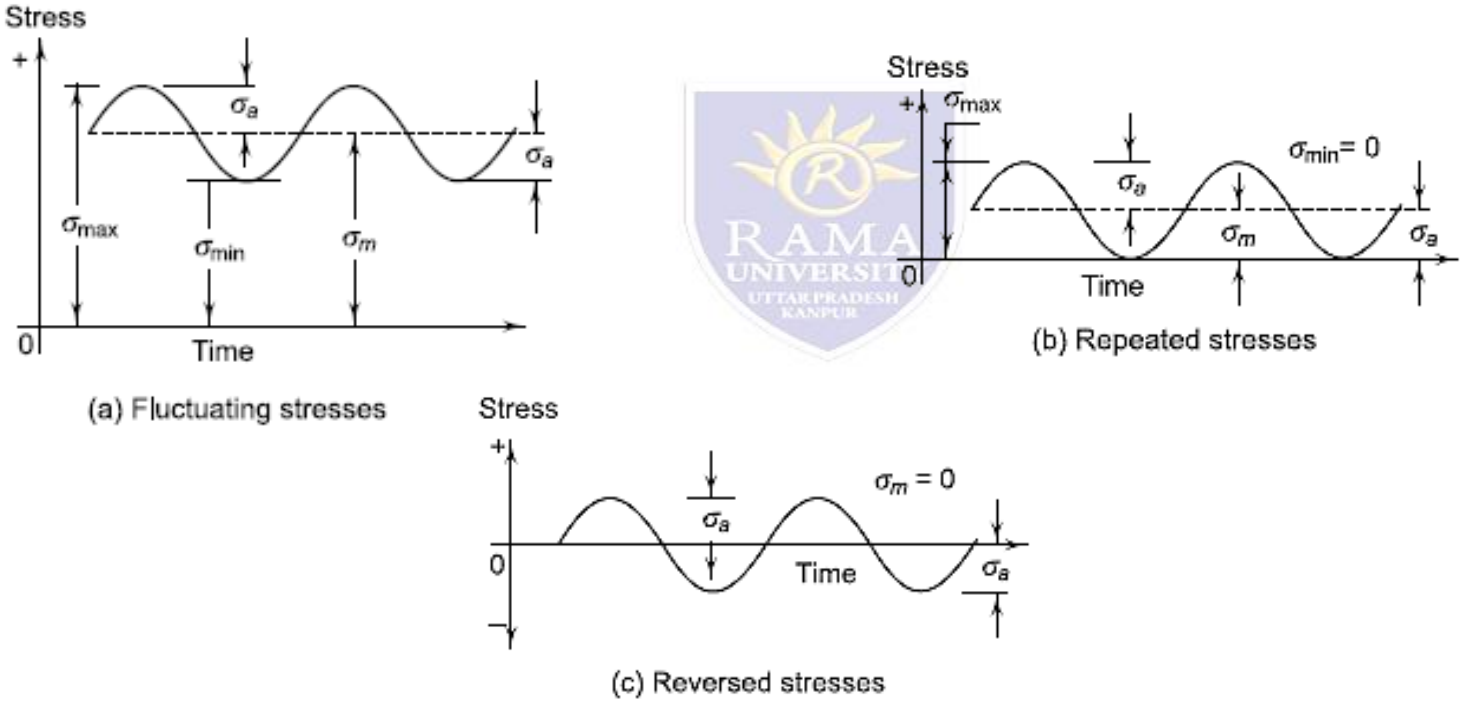

Fig. 5.15 *Types of Cyclic Stresses*

• FATIGUE FAILURE

- Fatigue failure is defi ned as time delayed fracture under cyclic loading. Examples of parts in which fatigue failures are common are transmission shafts, connecting rods, gears, vehicle suspension springs and ball bearings.
- There is a basic difference between failure due to static load and that due to fatigue.
- The failure due to static load is illustrated by the simple tension test. In this case, the load is gradually applied and there is suffi cient time for the elongation of fi bres.
- In ductile materials, there is considerable plastic fl ow prior to fracture.
- This results in a silky fi brous structure due to the stretching of crystals at the fractured surface. On the other hand, fatigue failure begins with a crack at some point in the material. The crack is more likely to occur in the following regions:
- (i) Regions of discontinuity, such as oil holes, keyways, screw threads, etc.
- (ii) Regions of irregularities in machining operations, such as scratches on the surface, stamp mark, inspection marks, etc.
- (iii) Internal cracks due to defects in materials like blow holes

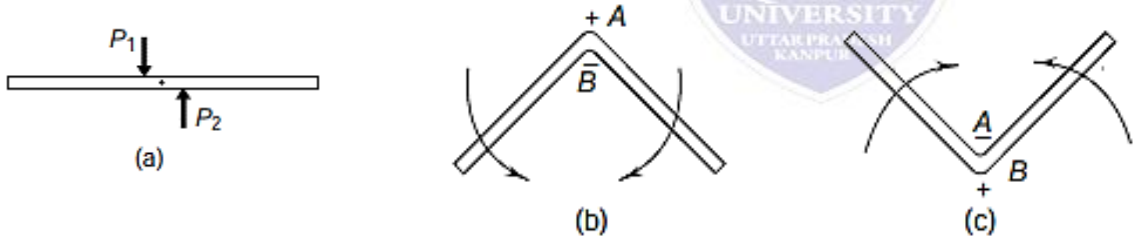

Fig. 5.16 *Shear and Fatigue Failure of Wire: (a) Shearing of Wire (b) Bending of Wire (c) Unbending of Wire*