



IIT ROORKEE



NPTEL ONLINE
CERTIFICATION COURSE

Failure Analysis & Prevention

Introduction: Need and Scope

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Failure analysis

- FA is a systematic approach of investigation to establish the important causes of the failure.

Therefore, it is worth to familiarize with

- fundamental causes of failure of mechanical components,
- general approach to be used for the failure analysis and prevention.



When to consider a failure

- In general, an engineering component or assembly is considered to have failed under the following three conditions when the component is
 - inoperable,
 - operates but doesn't perform the intended function
 - operates but safety and reliability is very poor



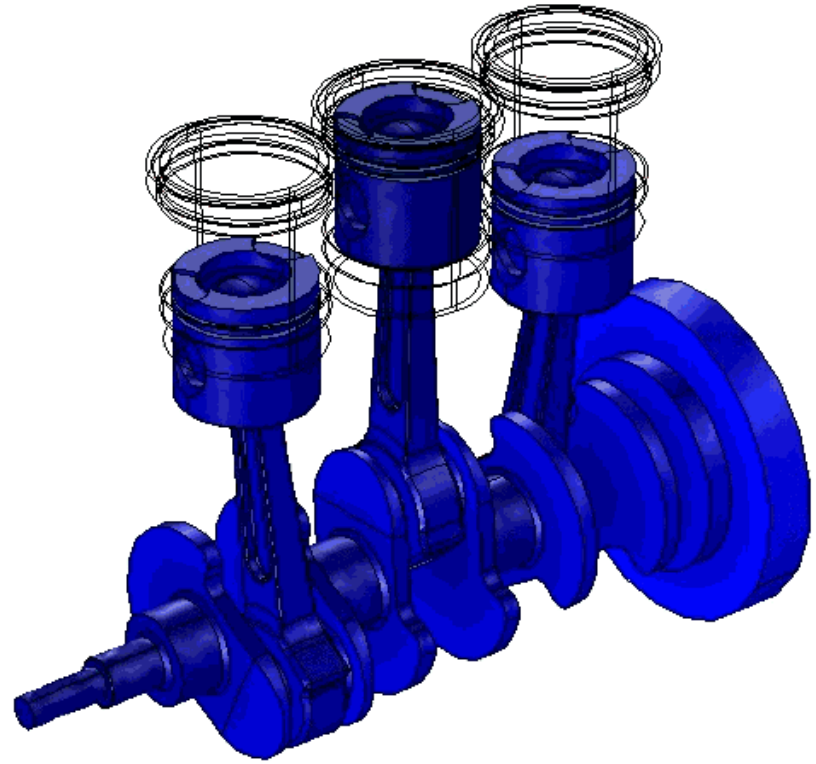
Failure of mechanical components

- Failure of a mechanical component can occur in many ways
 - elastic deformation is beyond acceptable limit,
 - excessive and unacceptable level of plastic deformation,
 - complete fracture and
 - loss of dimension due to variety of reasons.



Elastic deformation

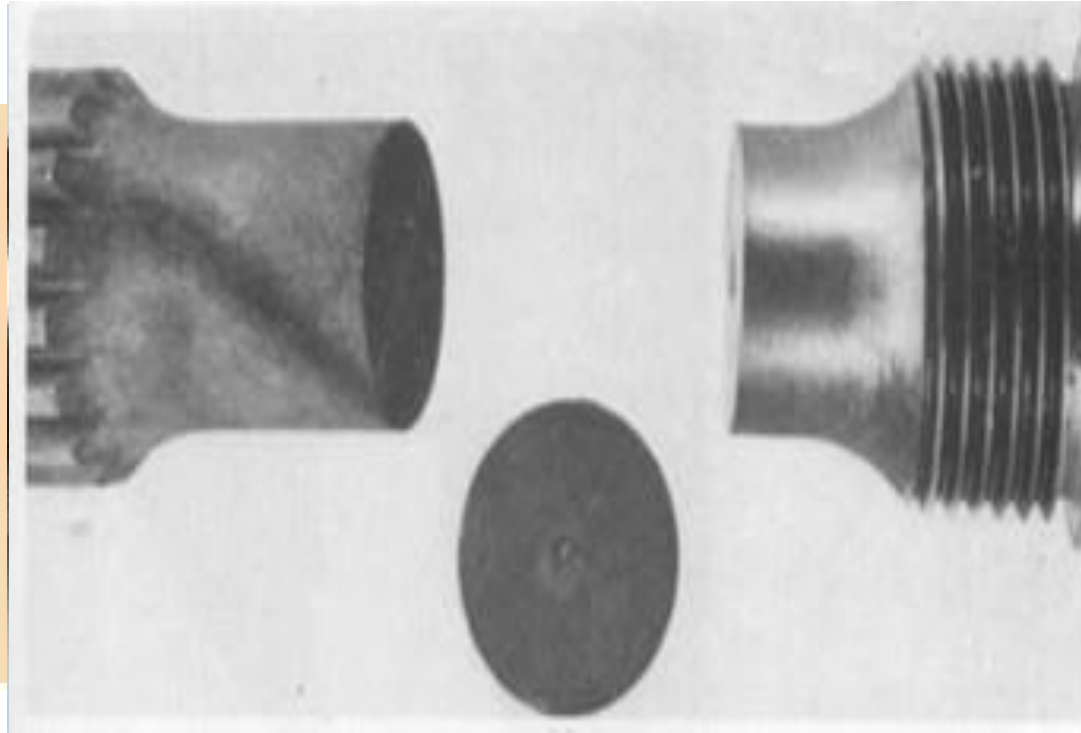
- Crankshaft in automobiles
- 1-2 degree per m



Plastic deformation



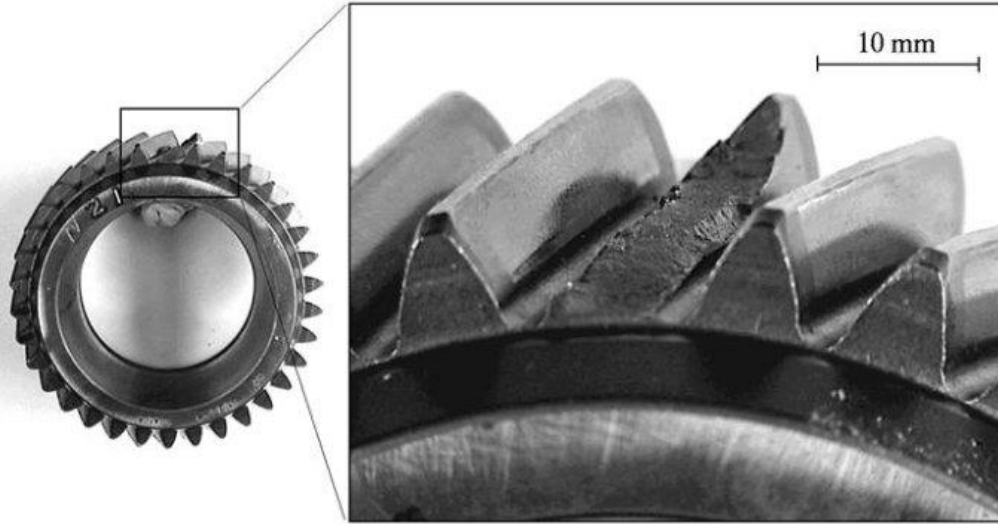
Photo 1. This shaft has been grossly overloaded by a torsional stress.



Creep



Fracture



wear



Gas turbine



Hydro-turbine

Fundamental causes of failure

- The failure of an engineering component in actual working conditions can occur due to very large of factors related with
 - design,
 - Materials,
 - manufacturing,
 - service conditions etc.



Need to know causes of failure

- To have systematic understanding on various factors that can lead to failure of mechanical components :
 - Improper design
 - Improper selection of materials
 - Defects and discontinuities in metal itself
 - Improper processing of materials
 - Poor service conditions
 - Poor assembling
 - Poor maintenance



Scope

- Metallurgical failures of mechanical components
- Fundamental causes of failure
- General procedure of failure analysis
- Application of fracture mechanism in failure analysis
- Use of Industrial engineering tools to understand failures