LIFE EXTENSION – FRACTURE MECHANICS

April 2021, Bilbao.

Service Technology Department

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DESIGN METHODS

Calculation Methods

- Safe-Life Design
  - Safety factors are applied
  - The component is design to survive within a certain defined period
  - Reduce the likelihood of unplanned maintenance/inspections
  - Reduce the likelihood of any failure

- Fatigue analysis using SN curves

- Damage Tolerance Design
  - Assuming the structure contains initial flaws, and this flaws:
    - will grow at a controlled rate under service loads or
    - the size of the initial flaw will not suppose a propagation
  - Maintenance required / Periodic inspections

- Fracture Mechanics analysis

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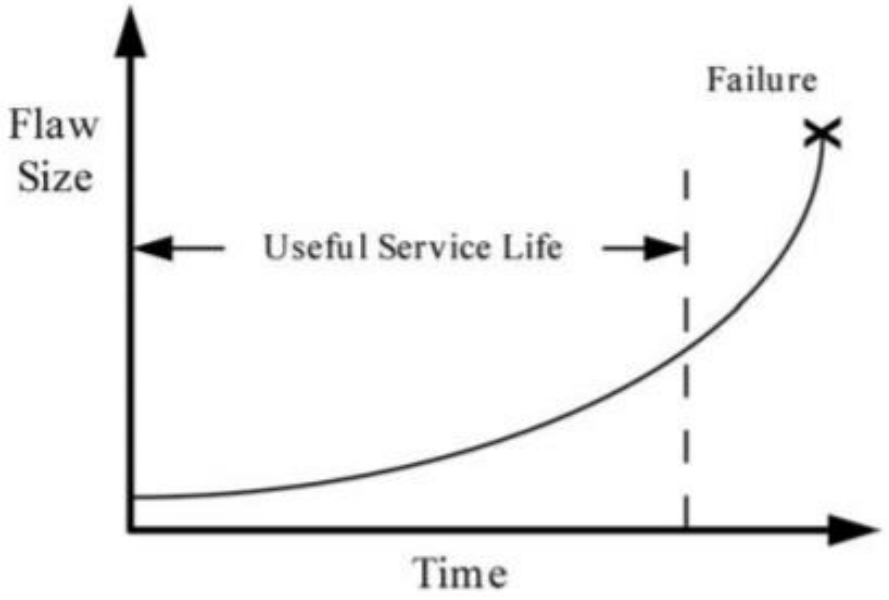
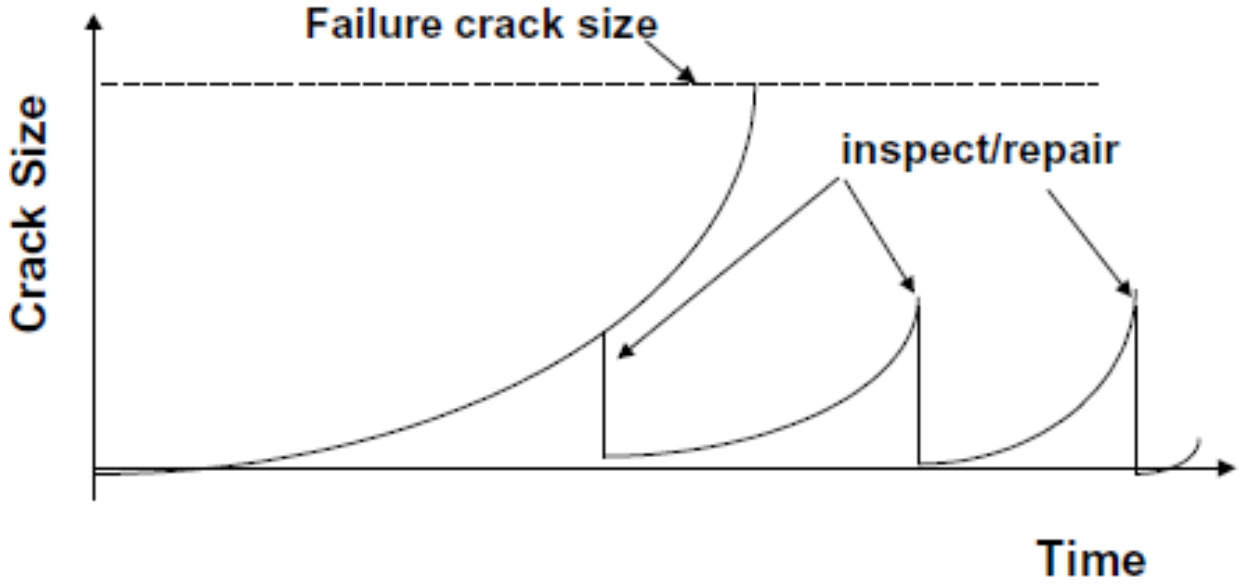
FRACTURE MECHANICHS - CRACK GROWTH

- The basis for this procedure is to reliably determine the propagation of a component defect and define the maximum crack size that could exist following an inspection and repair cycle, and then determine the remaining operational life of a component with this potential crack.

Crack growth approach



Periodic inspections or repairs to extend component life

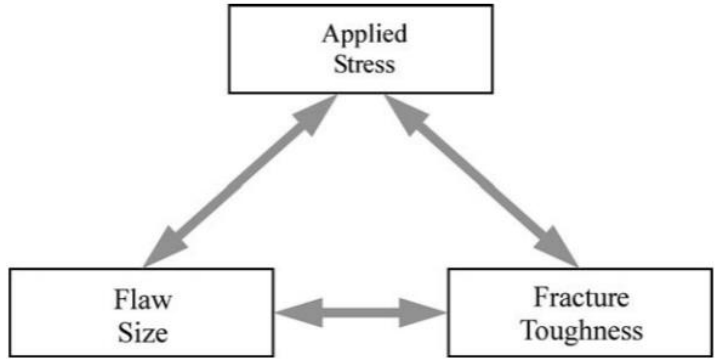


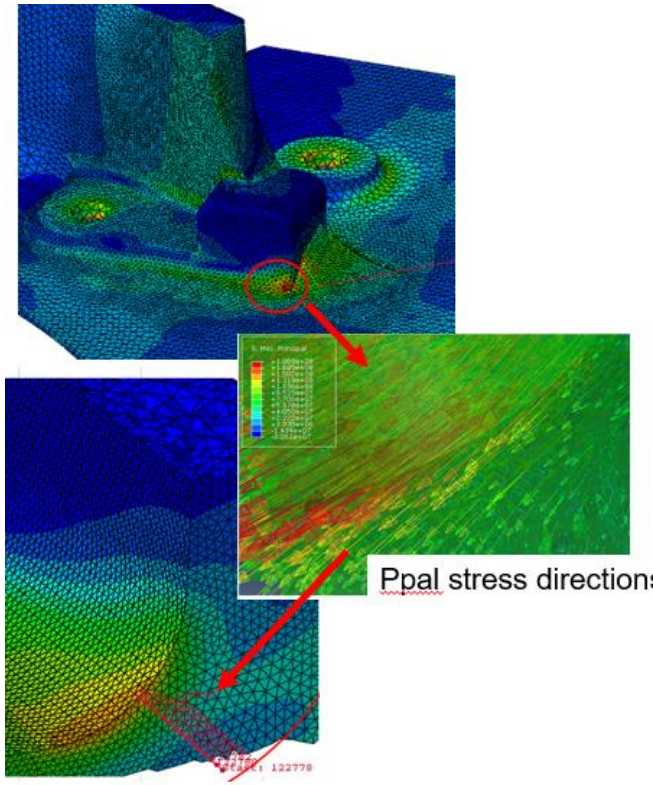
FRACTURE MECHANICS - INPUTS

- Material State
  - Material properties
    - Tensile properties: Re, Rm, E,
    - Fracture mechanics properties: K_{IC}, ΔK_{th}, da/dn

- Defect State
  - Crack type: Surface crack, through thickness, embedded crack,…
  - Crack size
    - Surface defects: Visual, Dye penetrant, magnetic particles, UT,…
    - Embedded cracks: UT

- Loading State
  - Dimensions of the component cross-section in which the defect is located
  - Stress distribution in the cross-section for the defect-free component





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Thank you!

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