Fracture Toughness vs. Test (NASGRO) | *Fracture Crack Growth vs. Test (NASGRO)* | *Fatigue Life Initiation, Growth (S-N) vs. Test*

MCQ Metals is a software toolset designed to characterize metal fracture and fatigue crack growth properties based on static tensile stress-strain behaviors. Engineers are able to characterize their metal properties as a function of manufacturing, geometric, and material variables in a short amount of time. The software offers the capability to determine fracture toughness, fatigue crack growth and fatigue cycle data using different material properties as inputs. Additionally, MCQ Metals allows mean metal properties and statistical distribution or allowables to be estimated.
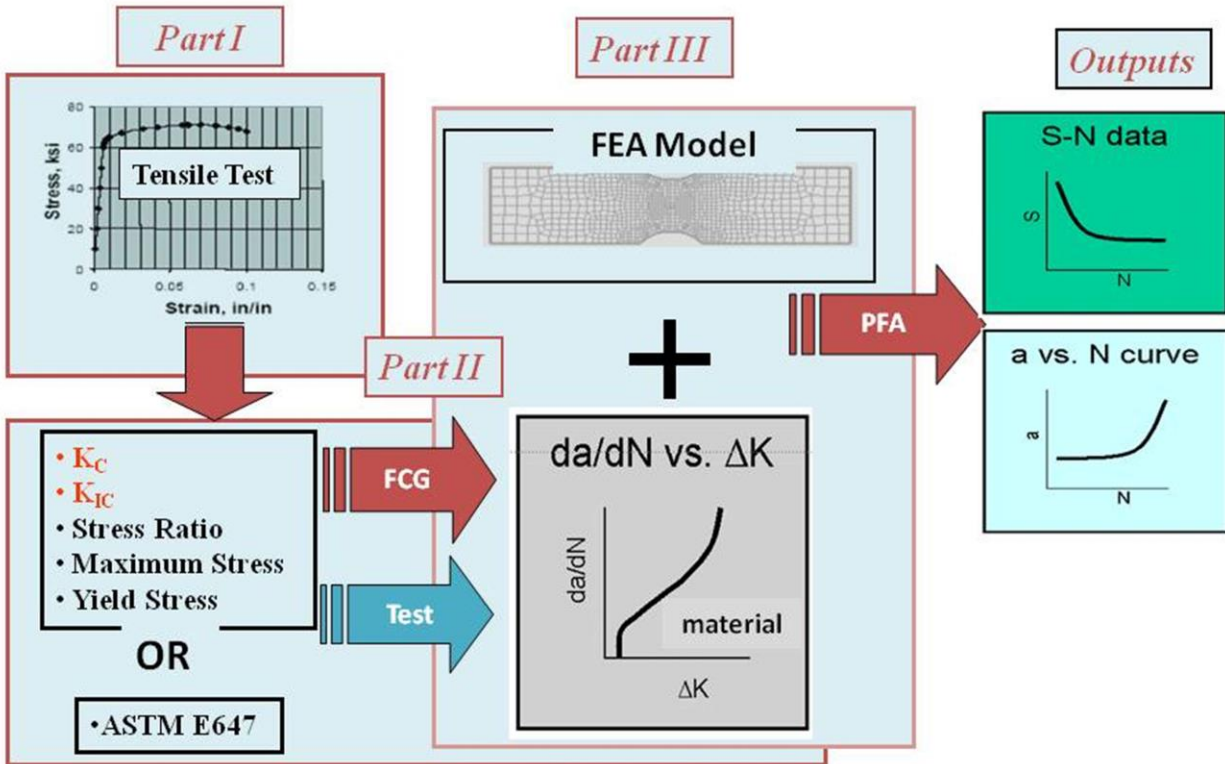
Highlights

✓ Characterize metal fracture and fatigue crack growth at RT/HT

- FTD vs. thickness calculated from stress-strain curve
- FCG regions (Threshold, Paris, Accelerated) curve (da/dn vs. DK) from fracture toughness
- S-N Curve of notched part
    - a-N curves from FCG curve
    - crack initiation: notched specimen using material (un-notched) S-N curve
- Creep crack growth vs. time from full stress-strain curve
- Fatigue and creep interaction

✓ Include effects (i.e. account for scatter) of the following variables

- Geometry, manufacturing, material, account for scatter

✓ Perform probabilistic analysis:

- Estimate mean and statistical distribution of properties
- Probabilistic fracture toughness, probabilistic fatigue crack growth

✓ Includes vast library of material data (i.e. Titanium, Aluminum, Inconel, Steel)

Key Benefits

- ✓ Analytically predicts metallic material properties and performance
- ✓ Estimates S-N data for Kt>1 through combined progressive damage, fracture and finite element modeling
- ✓ Calculates number of cycles to crack initiation and crack propogation
- ✓ Calculates total life
- ✓ Determines Fracture Toughness, Fatigue Crack Growth and Fatigue Cycle Data
- ✓ When coupled with FE solver/GENOA predicts S-N curve of notched part for life prediction
- ✓ Supports validated material database

Modules

GUI	Base GUI for project management, setup and post-processing results
Fracture Toughness Determination	Provides users with both graphical and numerical data showing the variation in fracture toughness as a function of material thickness.
Fatigue Crack Growth	Estimate the Fatigue Crack Growth rate properties (da/dn versus ΔK) using input from various sources—including virtual testing done in FTD module.
Probabilistic Fracture Toughness	Accounts for scatter in tested metal material properties and its effect on the fracture toughness of the material.
Probabilistic Fatigue Crack	Accounts for scatter in tested metal material properties and its effect on the fatigue crack behavior of the material especially on the threshold, paris, and excelerated regions.
TRCrack	Predicts fracture toughness and crack growth behavior in metals for different specific shapes including the effect of temperature.

Fracture Toughness, Fatigue Crack Growth, S-N, a-N