

Post-Autofrettage Linear Elastic Crack Growth Simulations using NASGRO

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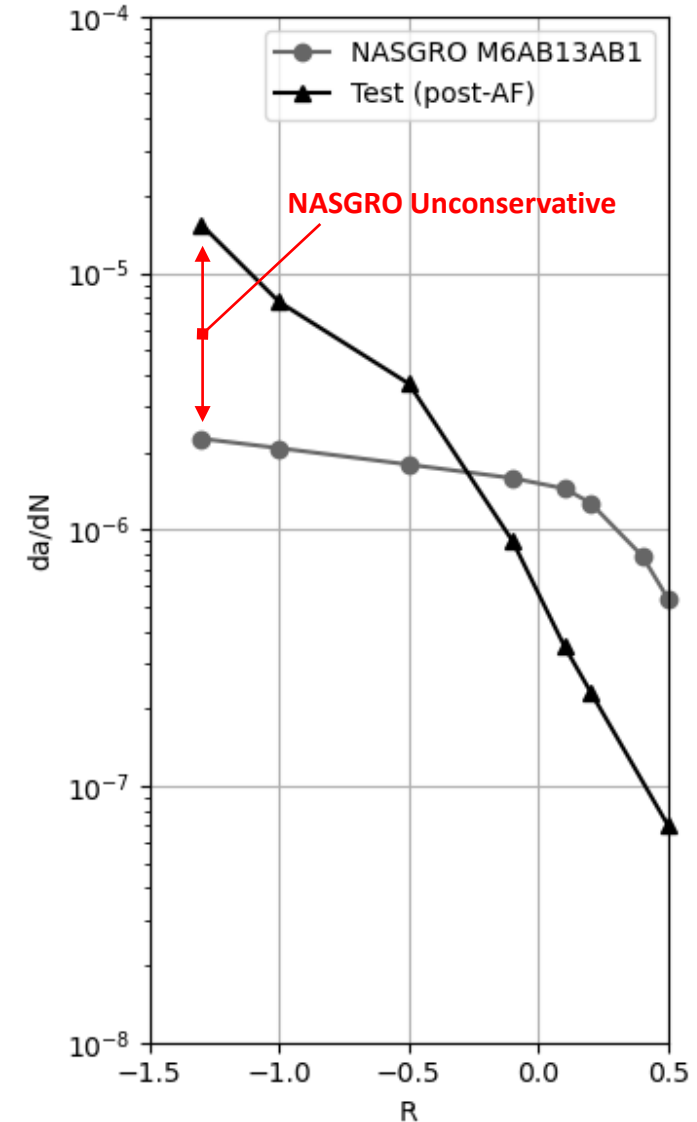
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Problem

- ANIS/AIAA S081B allows damage tolerance life calculations for elastically responding COPVs to ignore the influence of the elastic-plastic autofrettage cycle when evaluating the elastic cycles.
- Crack blunting due to the autofrettage cycle can force the crack to remain open even for compressive loads (i.e., $R < 0$).
 - This will allow the full stress range to influence the crack growth rate (i.e., no crack closure) and result in unconservative crack growth rates.



Lack of Built-in Solutions

Closure bypass option exists in NASGRO, but the stress intensity factor range is truncated such that:

$$\Delta K_{eff} = K_{max} \text{ for } R \leq 0$$

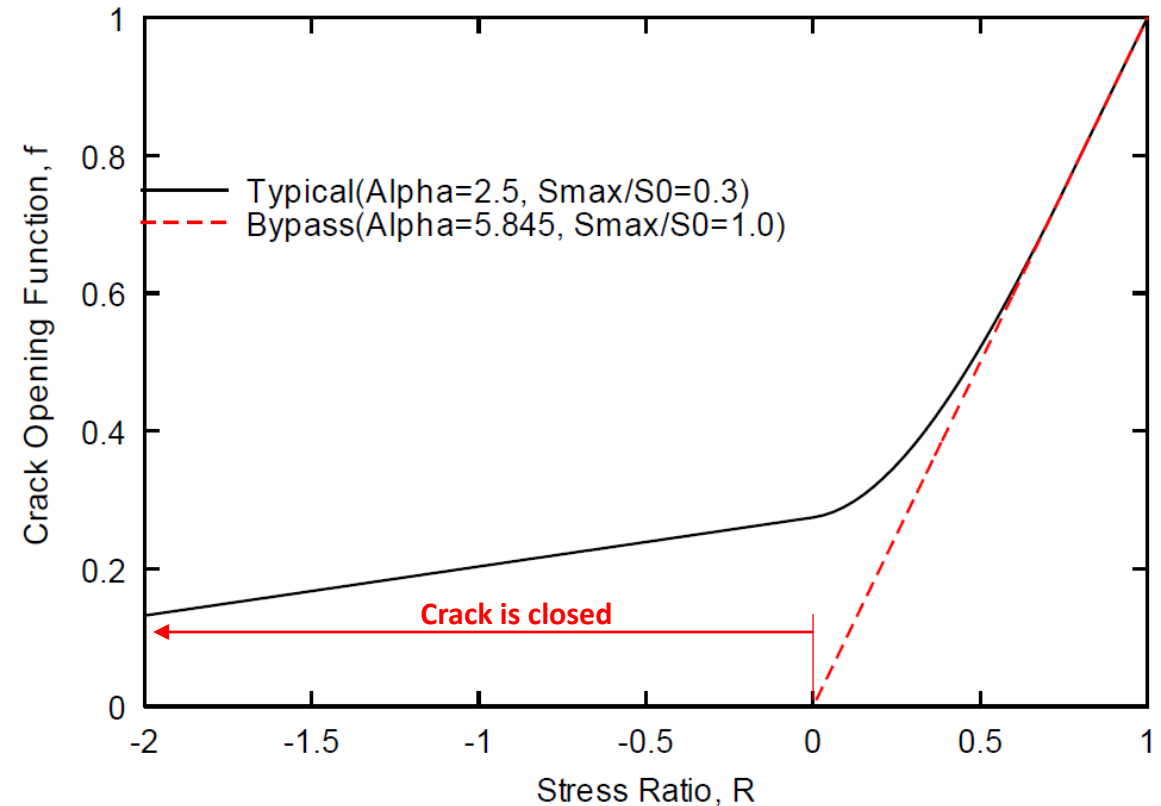


Figure 2 – Crack opening function vs. stress ratio

From: NASGRO Fracture Mechanics and Fatigue Crack Growth Analysis Software Reference Manual (Version 9.1), 2019

Suggest

Add a flag in the NASGRO GUI to force the full stress intensity factor range to be calculated for the entire stress range (no truncation of negative stresses). Enabling the flag would activate the full stress intensity factor range for all calculations of da/dN (i.e., equations and tabular)

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