

Fatigue Crack Growth on Several Materials under Single-Spike Overloads and Aircraft Spectra

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Outline of Presentation

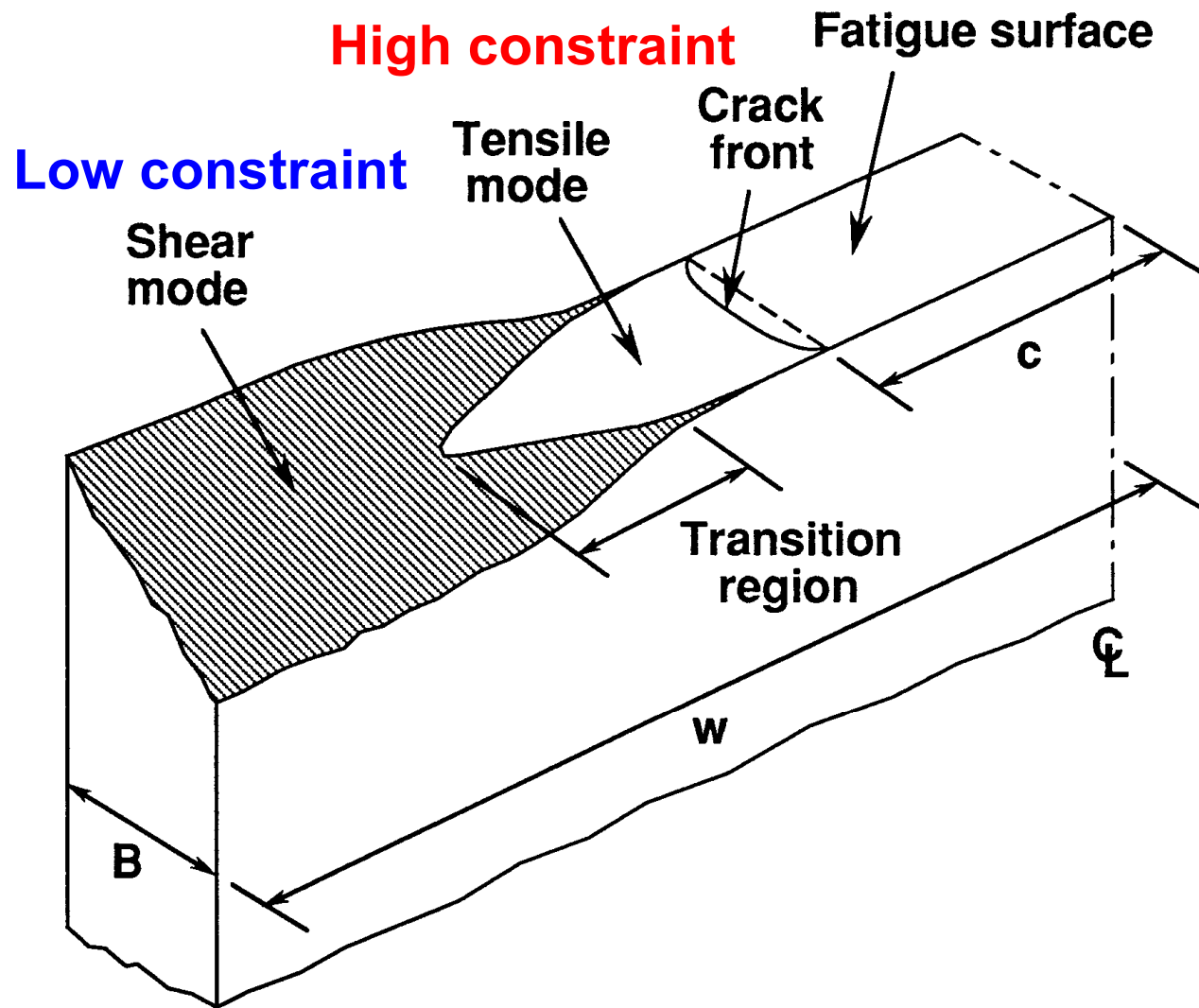
- **Plane-strain to plane-stress fatigue-crack growth behavior**

Flat-to-Slant Crack Growth and the Associated Constraint-Loss Behavior

Schijve (1966)

ASTM STP-415:

Crack-growth rate was “**constant**” at transition on 2024-T3 Alclad for wide range in R



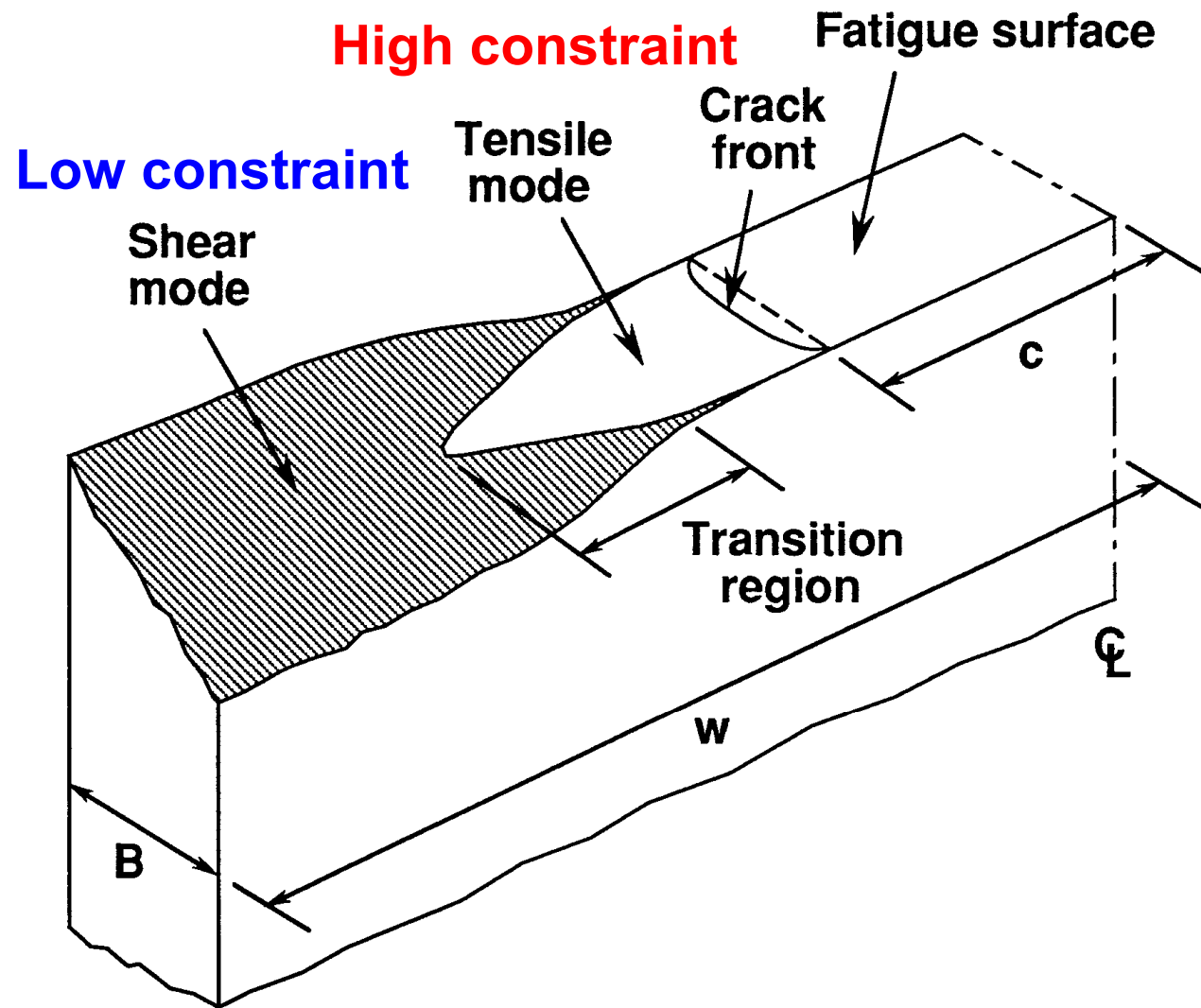
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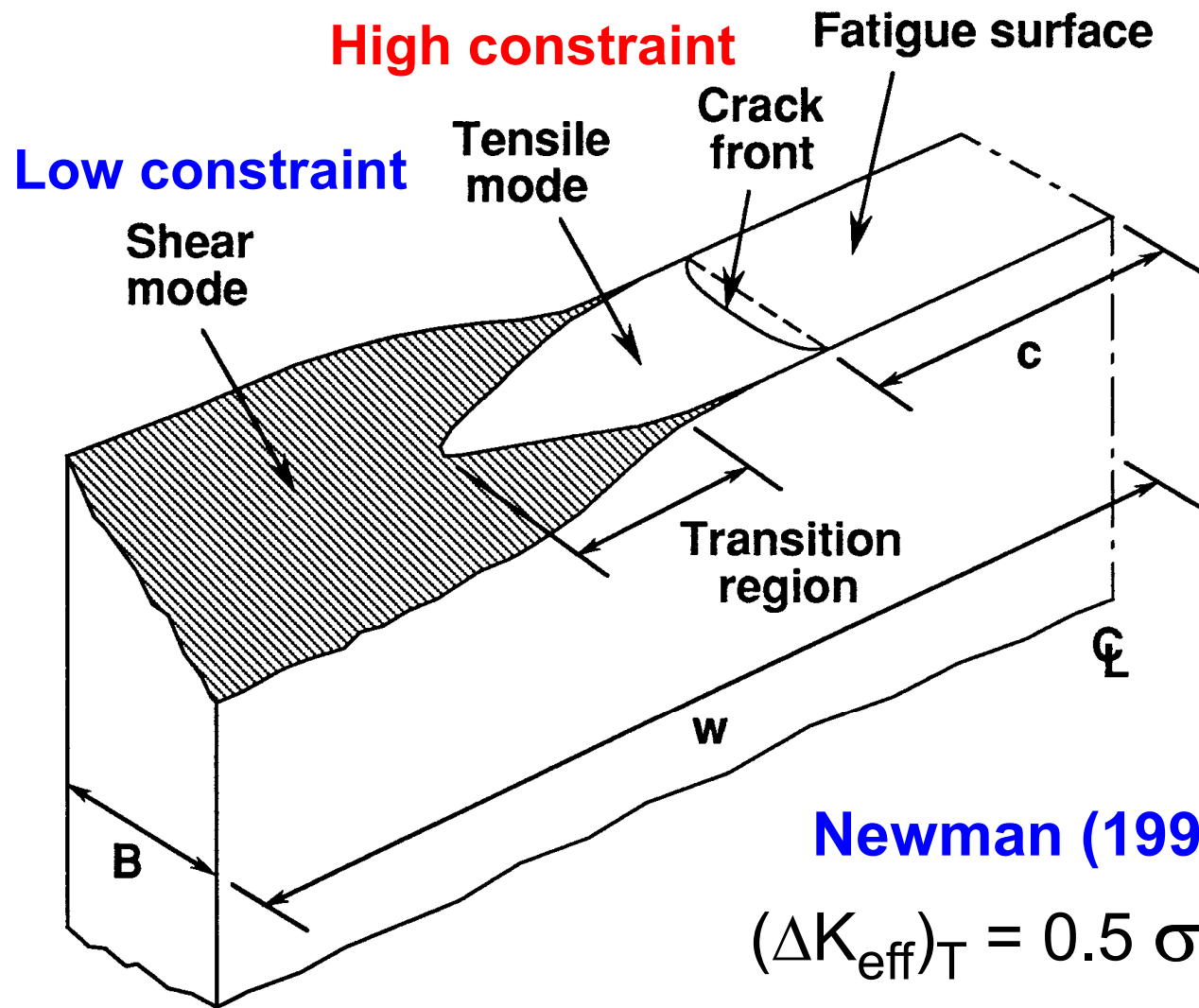
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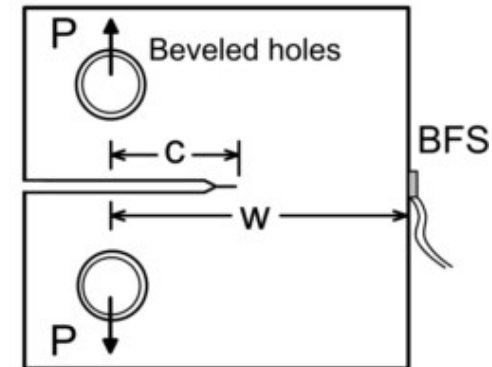
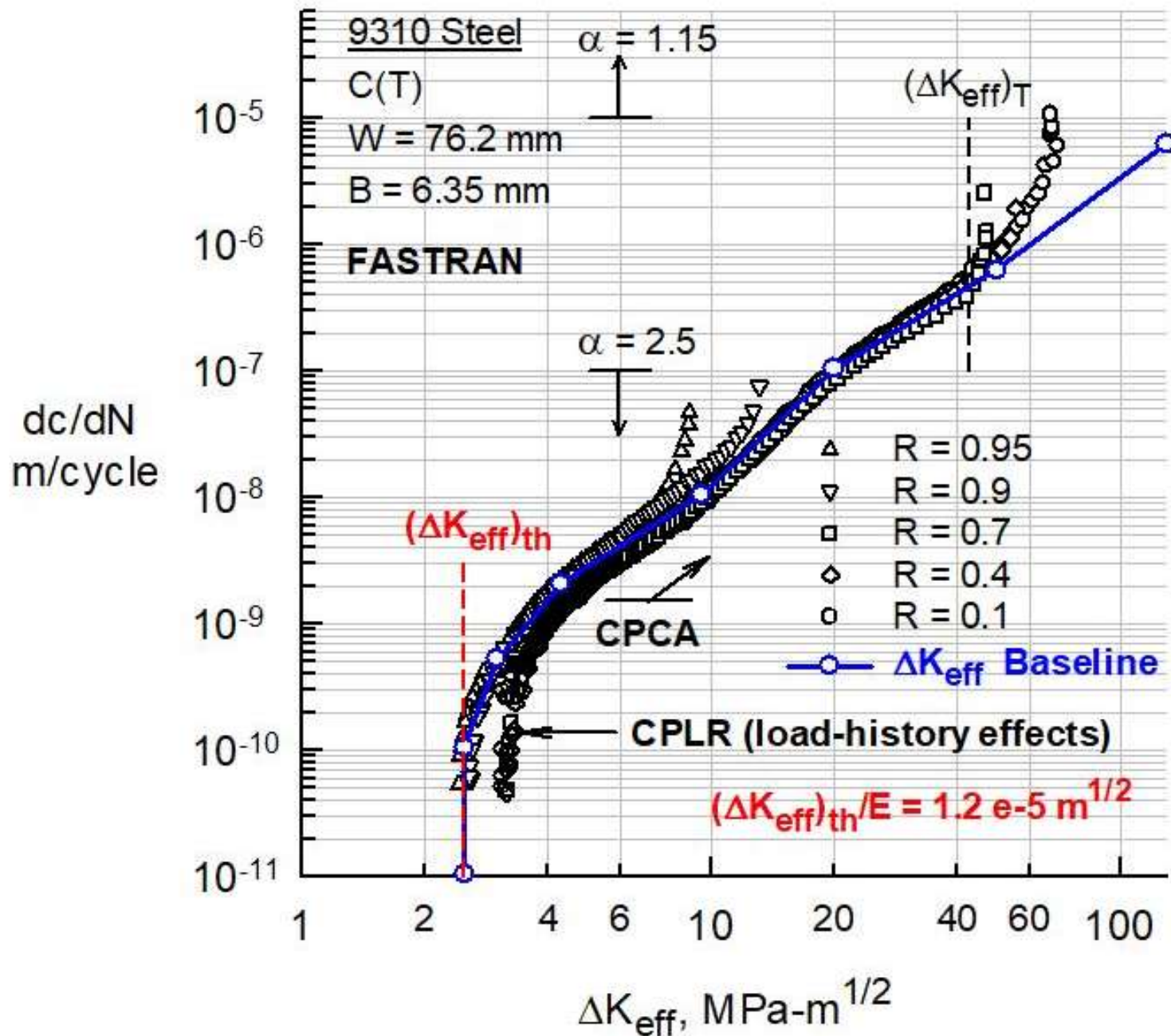
Newman (1992)

$$(\Delta K_{\text{eff}})_T = 0.5 \sigma_0 B^{1/2}$$

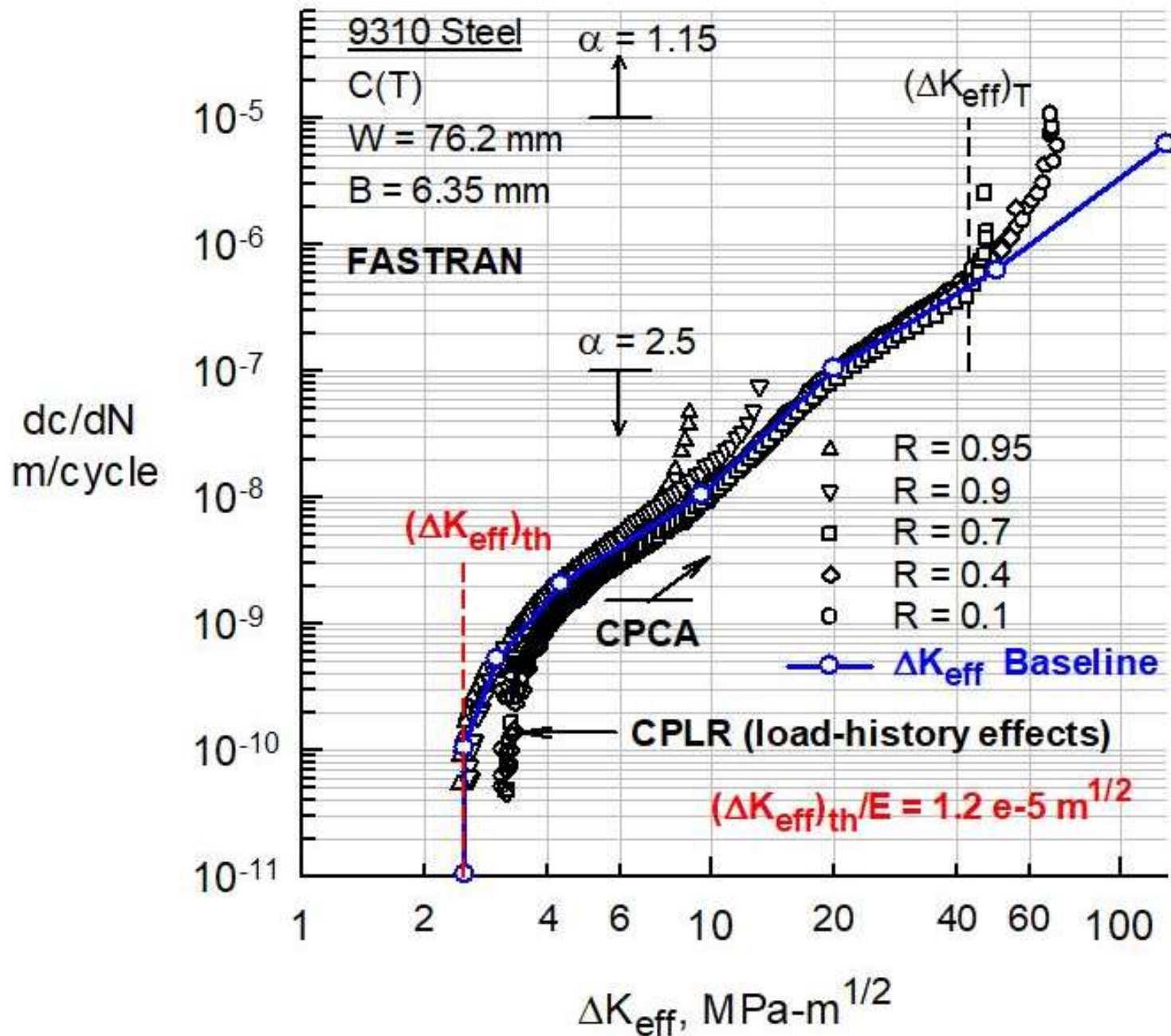
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- Plane-strain to plane-stress fatigue-crack growth behavior
- **Fatigue-crack-growth-rate against ΔK_{eff} correlations**

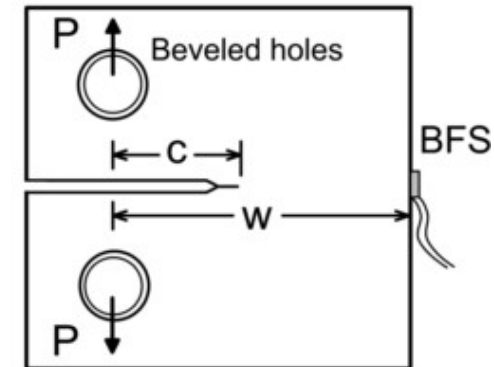
Effective SIF Relation for 9310 Steel Plate C(T) Specimens



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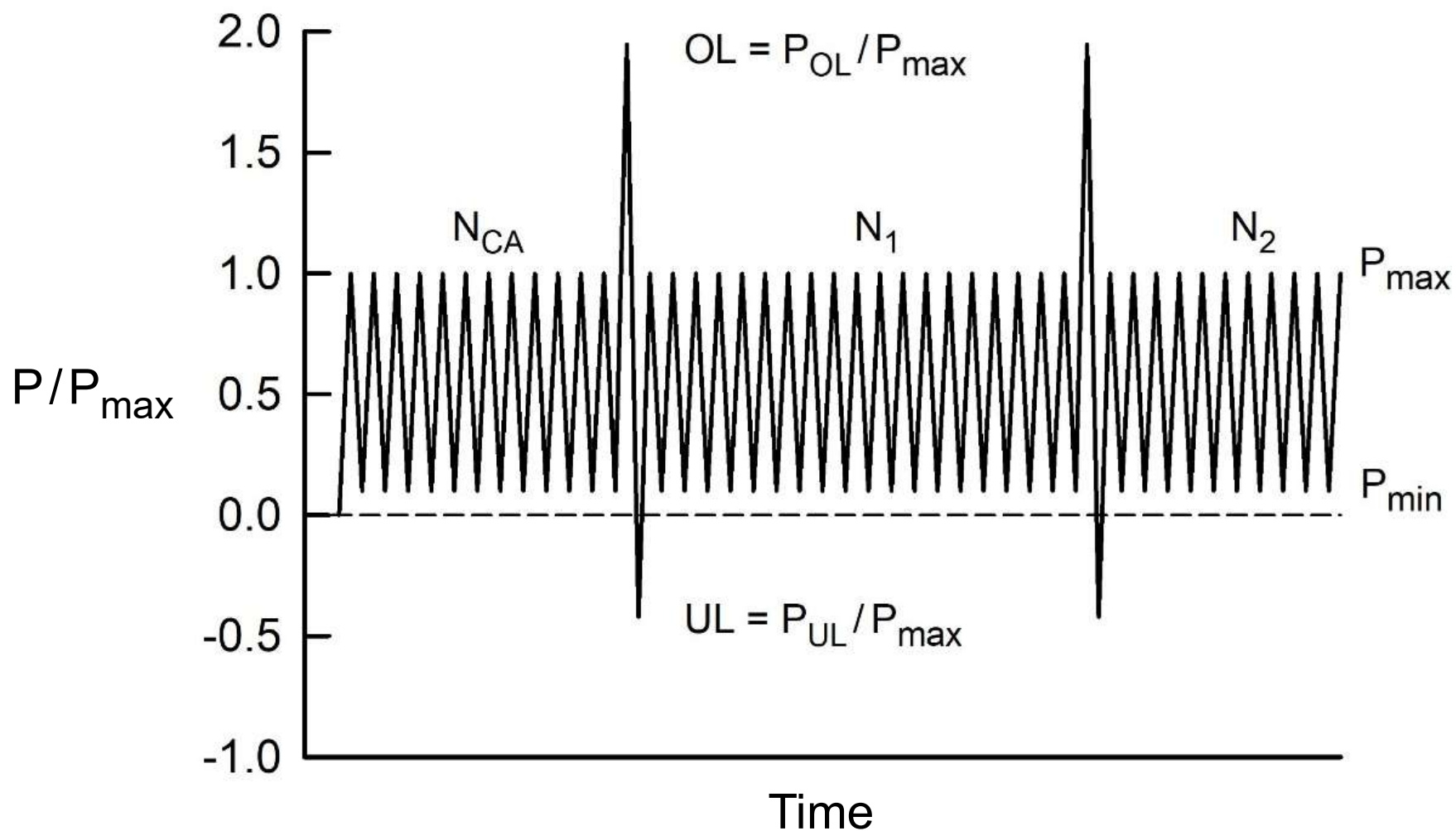
Need larger width specimens !



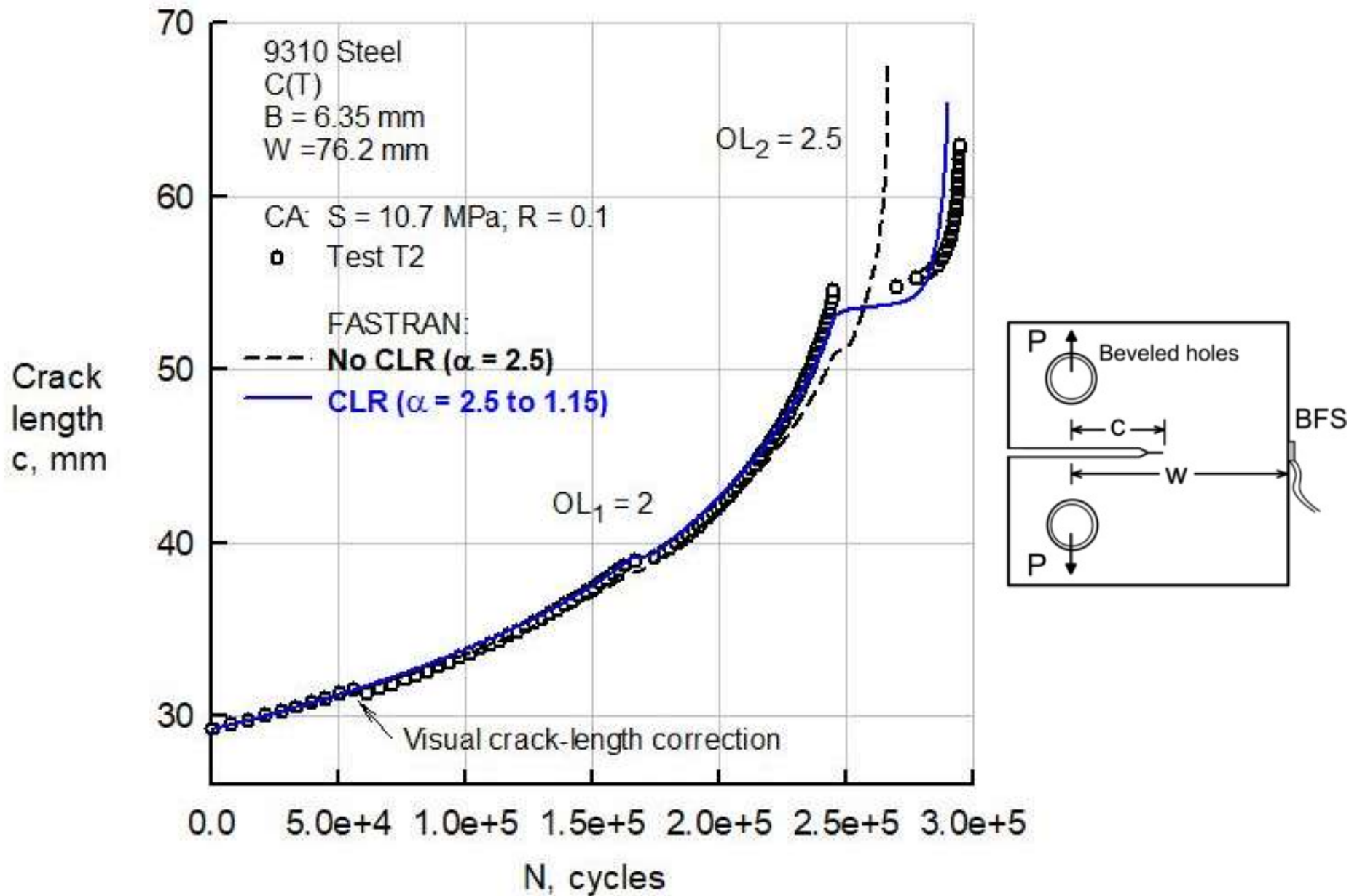
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- **Single-spike overload/underload tests and analyses**
 - 9310 Steel Plate C(T) Newman et al. (2013)

Repeated Single-Spike Overload/Underload History under Constant-Amplitude Loading



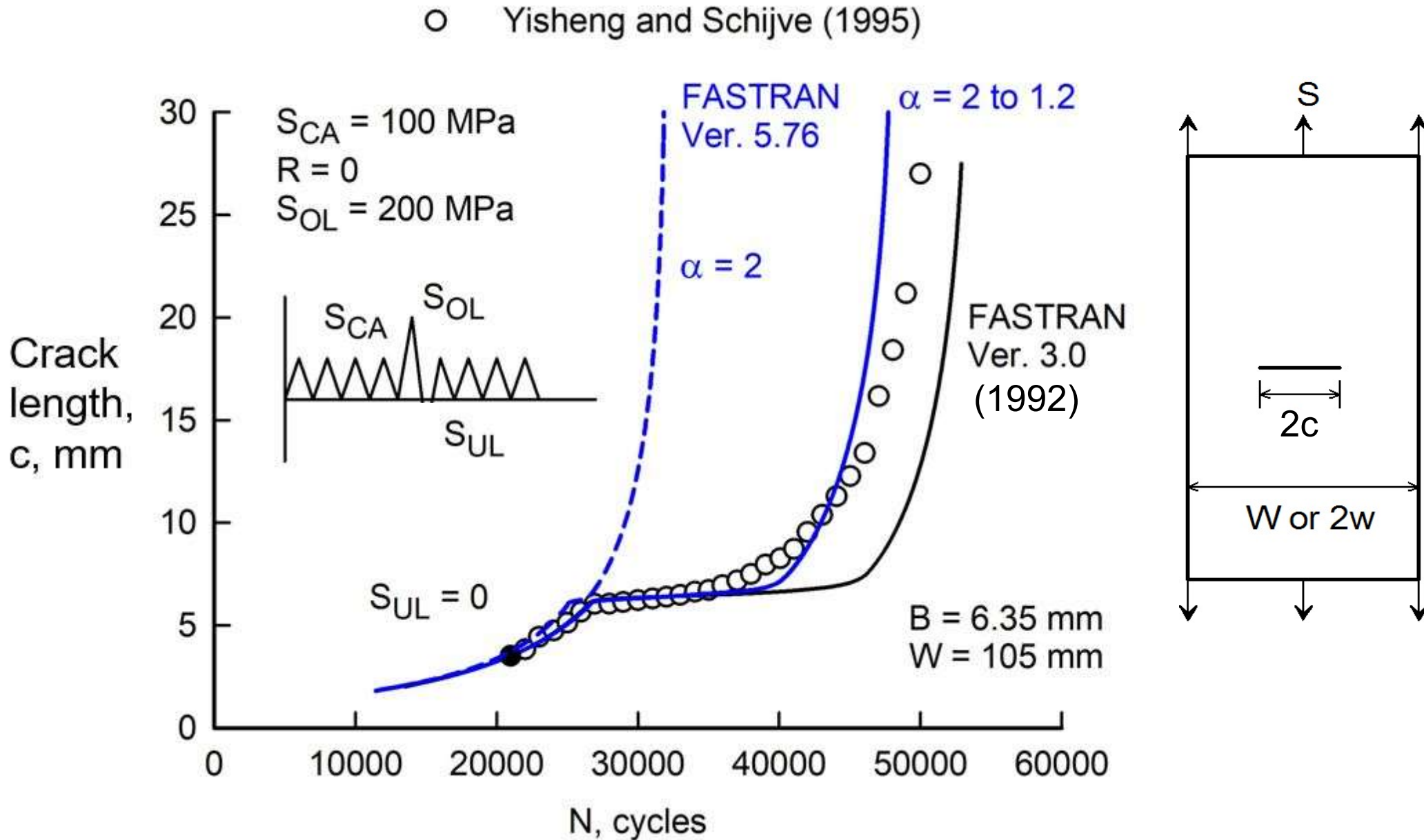
Measured and Predicted Crack-Length-against-Cycles for C(T) Specimen made of 9310 Steel Plate under Repeated Single-Spike Overloads



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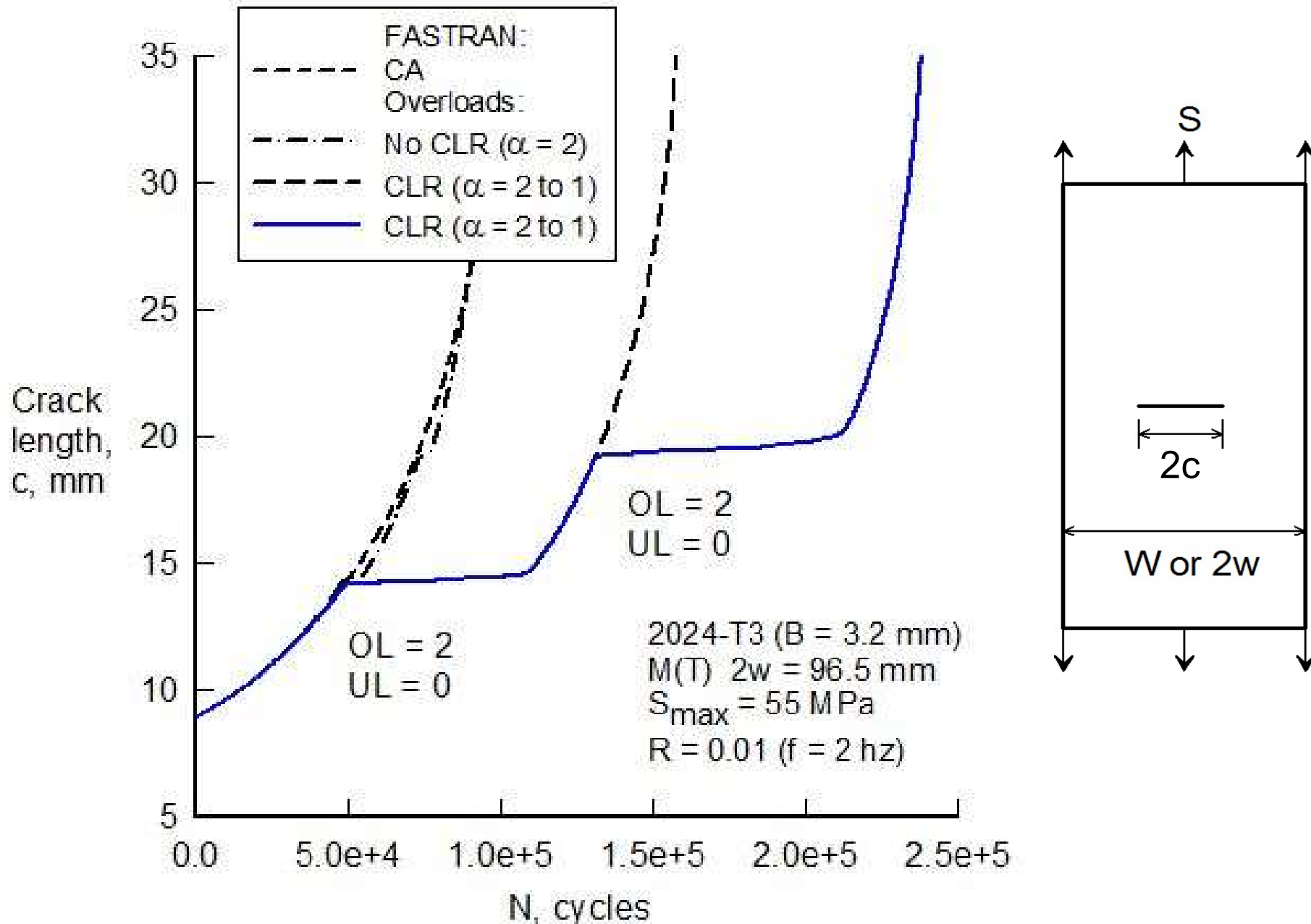
Test and Analyses of a Single-Spike Overload on 2024-T3 Plate



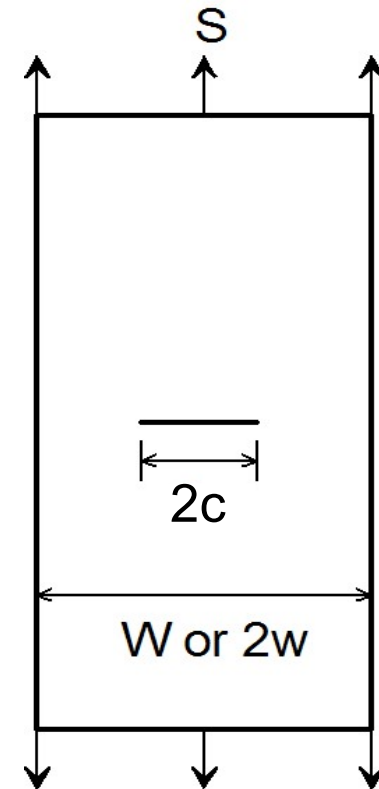
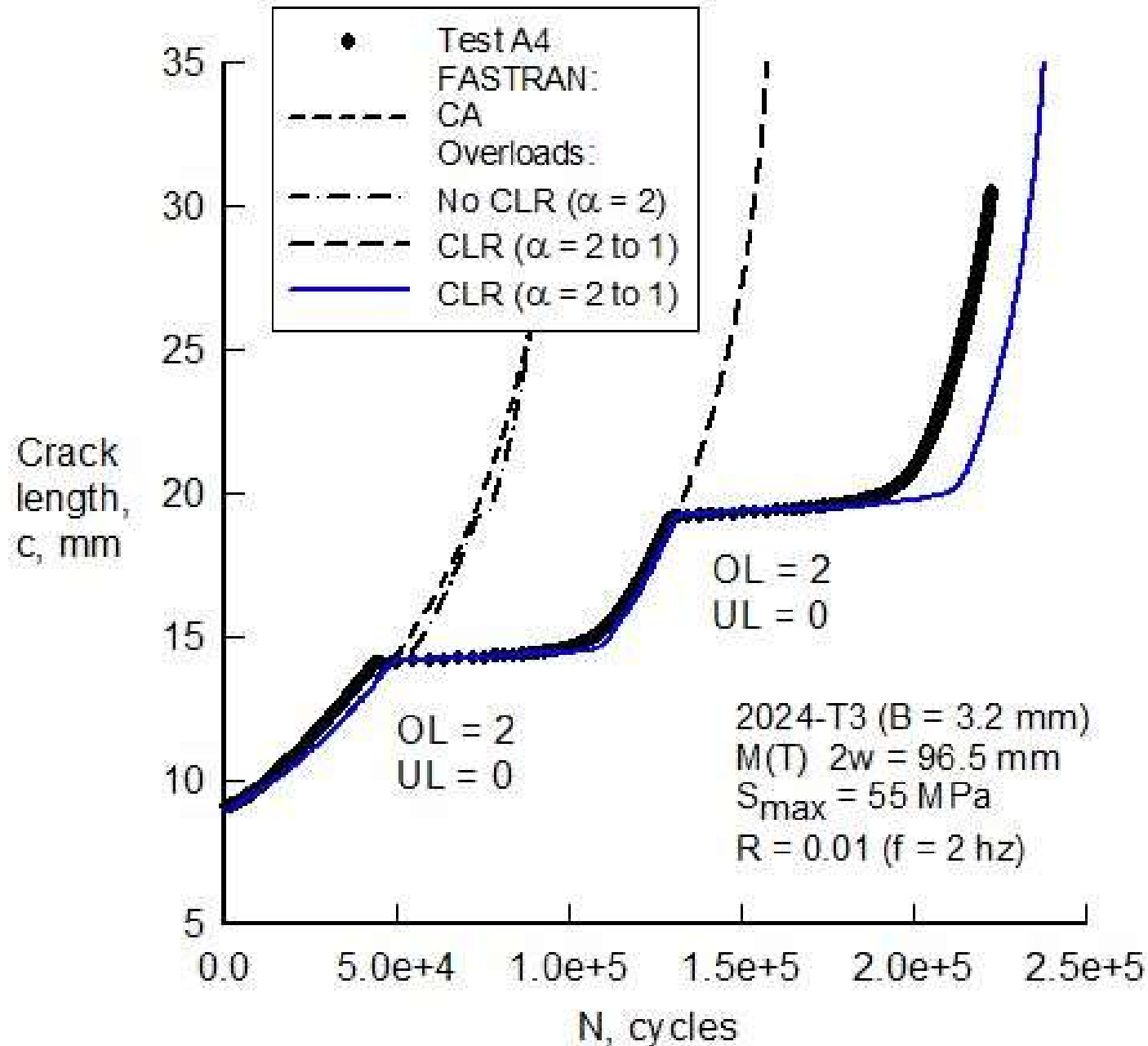
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 - 2024-T3 Sheet M(T) Newman-Walker

Predicted Crack-Length against Cycles under Repeated Single-Spike Overloads in 2024-T3 Sheet



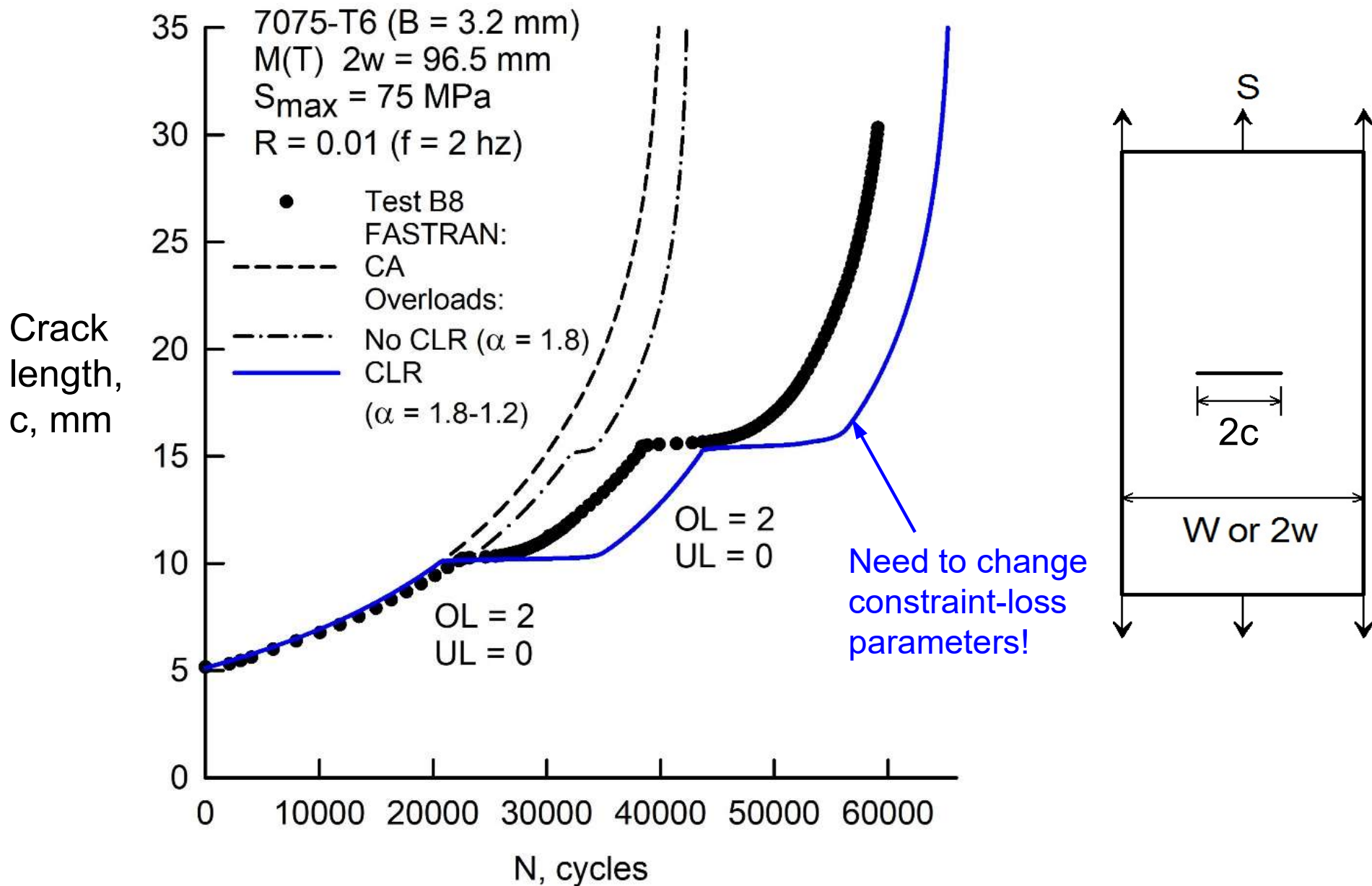
Measured and Predicted Crack-Length against Cycles under Repeated Single-Spike Overloads in 2024-T3 Sheet



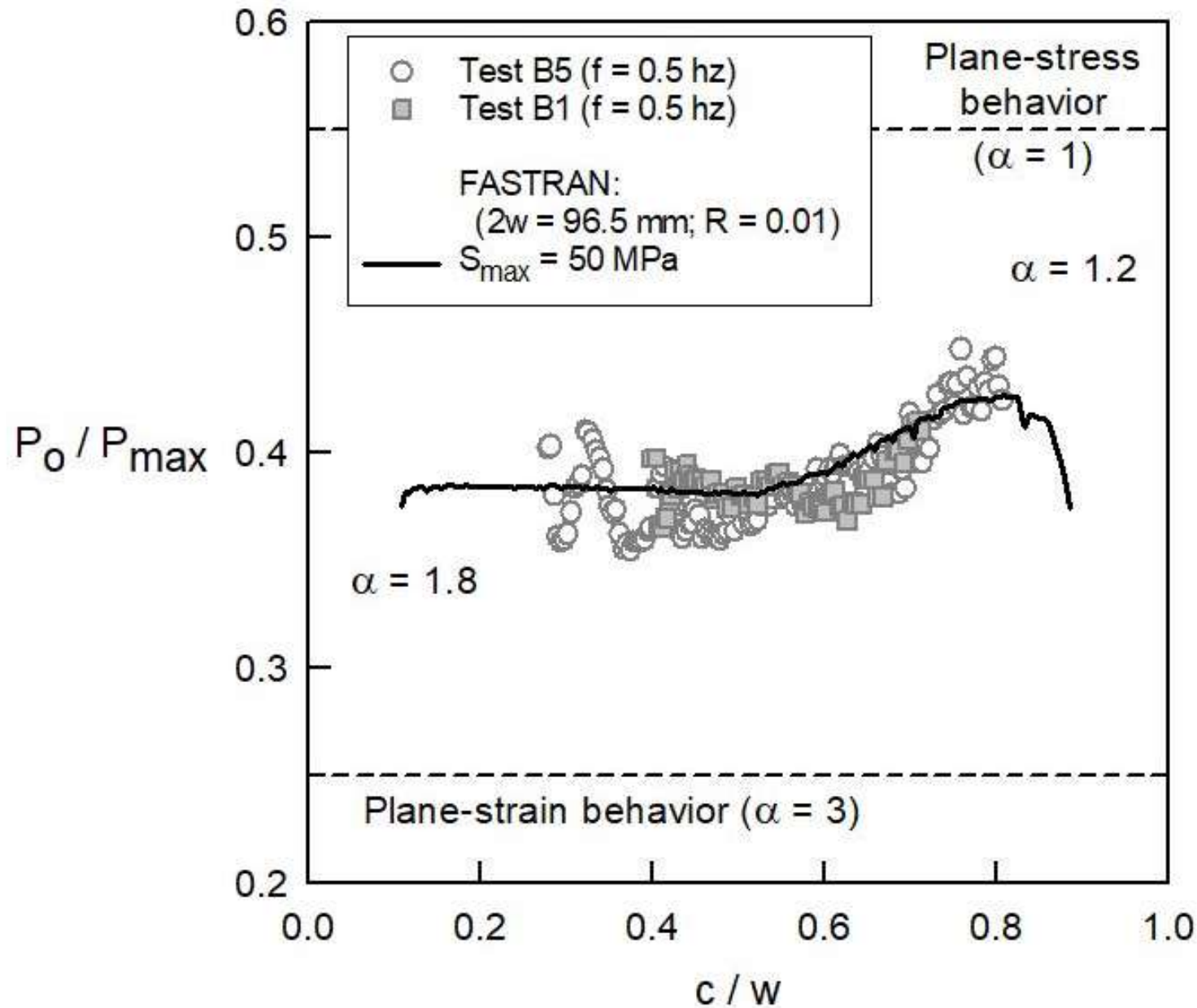
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 - 7075-T6 Sheet M(T) Newman-Walker

Measured and Predicted Crack-Length against Cycles under Repeated Single-Spike Overloads in 7075-T6 Sheet



Measured and Calculated Constraint-Loss Behavior for 7075-T6 Sheet under Constant-Amplitude Loading

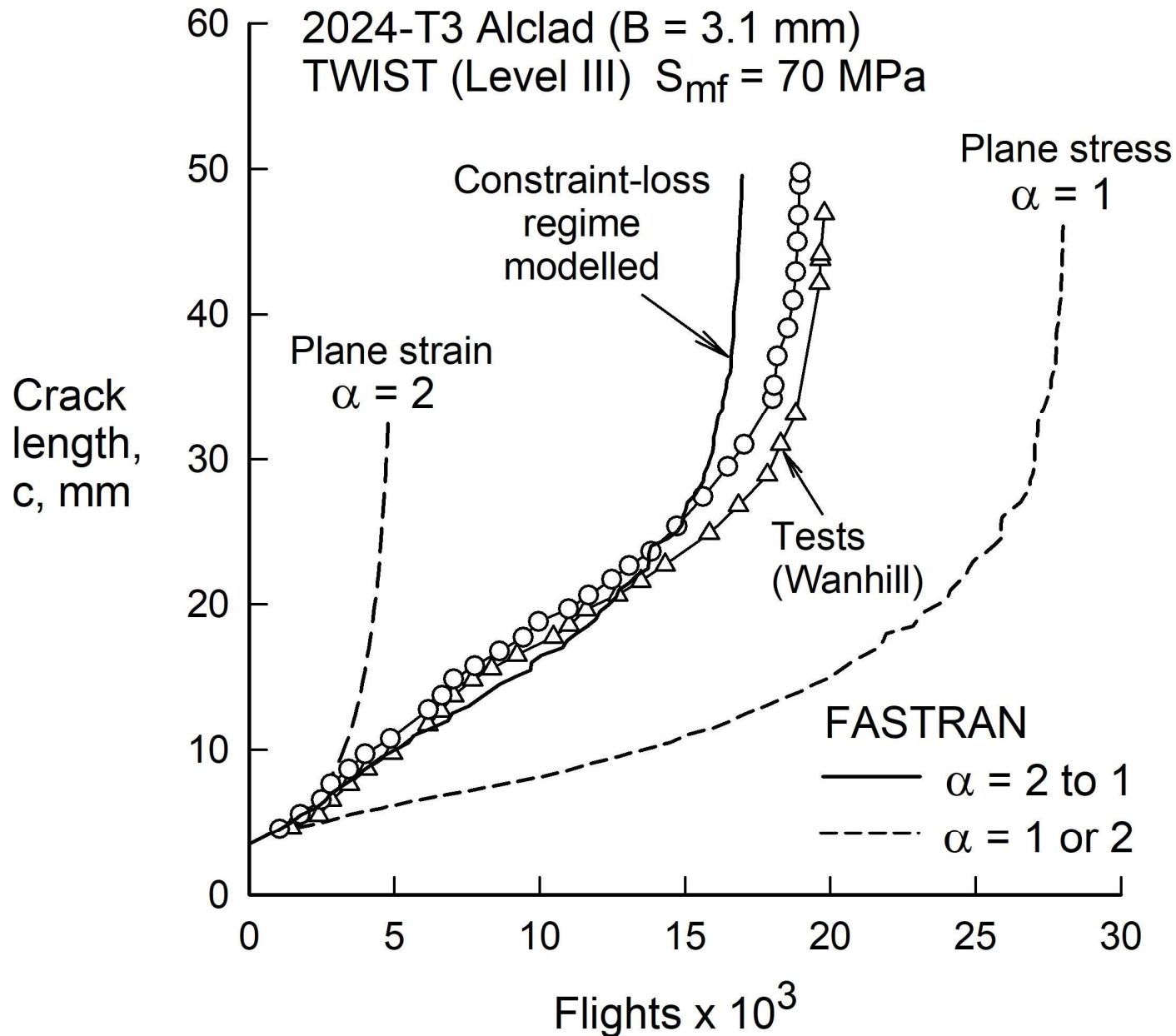


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- **TWIST spectrum crack-growth tests (Wanhill) and analyses**

Crack Growth under TWIST (Level III) Spectrum Loading

Wanhill (1977), Newman (1992)



Concluding Remarks

- Transition from plane-strain to plane-stress behavior (flat-to-slant crack growth) occurs at a **constant crack-growth rate** and is controlled by $(\Delta K_{\text{eff}})_T$.

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Thank You, Very Much !

Questions ?



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