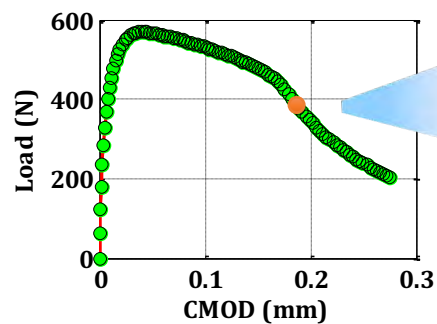
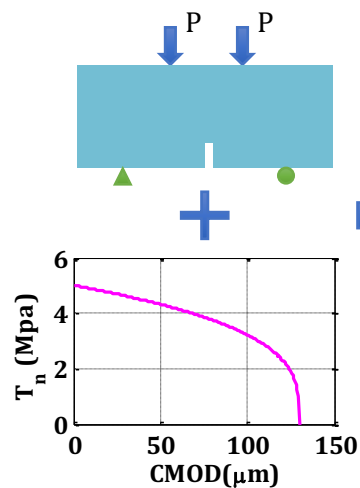


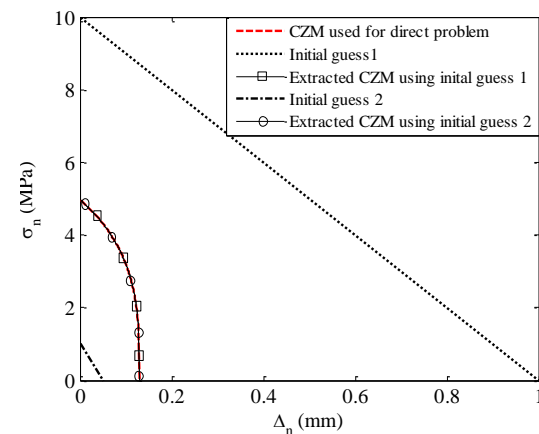
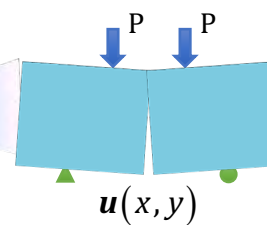
Failure property extraction

- Direct vs. Inverse:

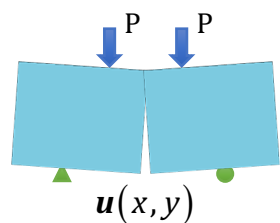
Forward Problem



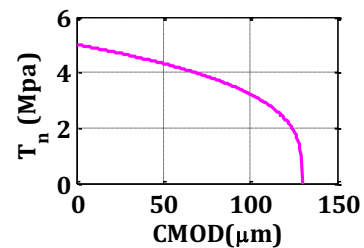
Global Response



Inverse Problem



Optimization
Nelder-Mead Scheme



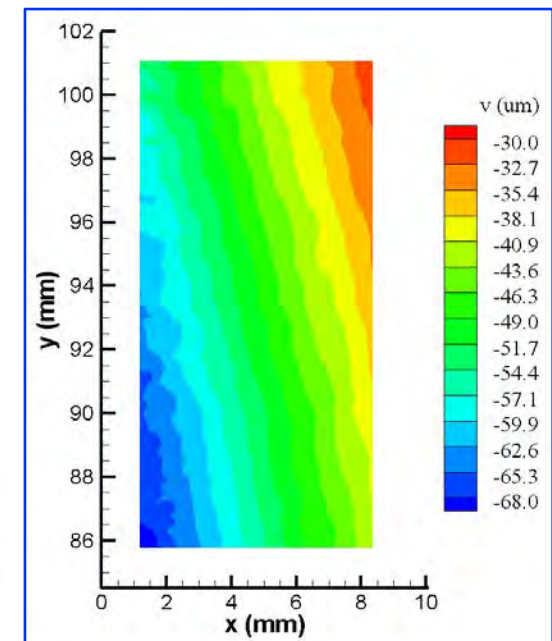
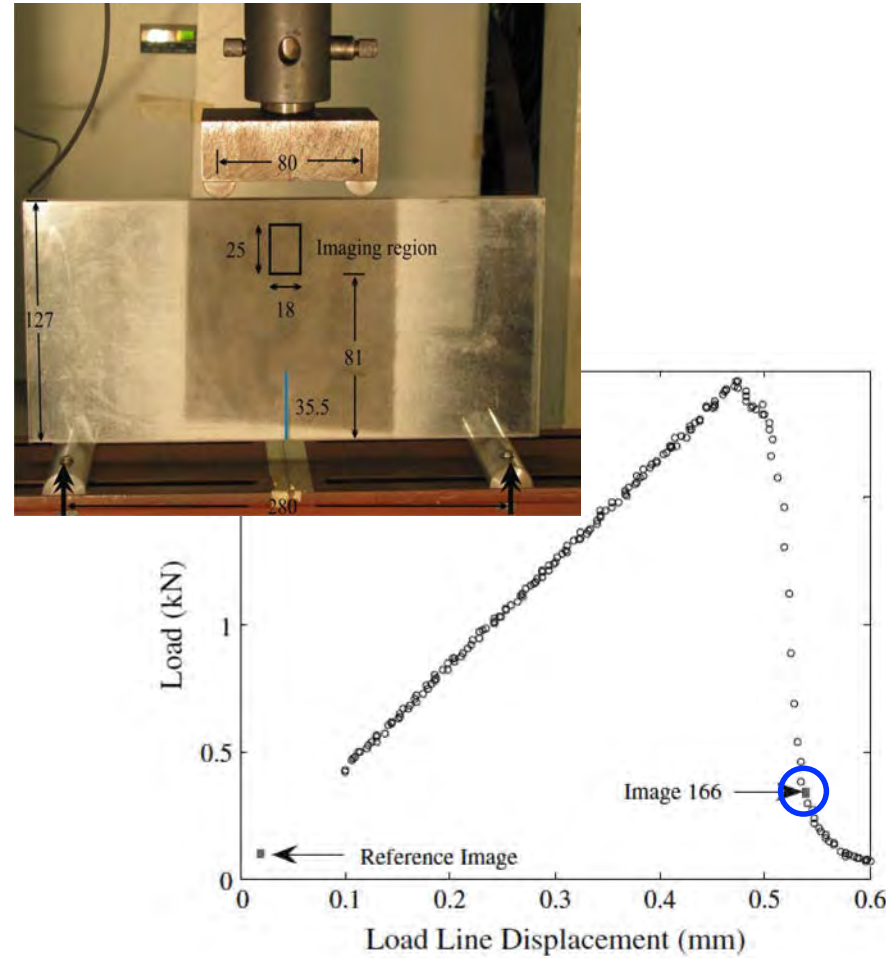
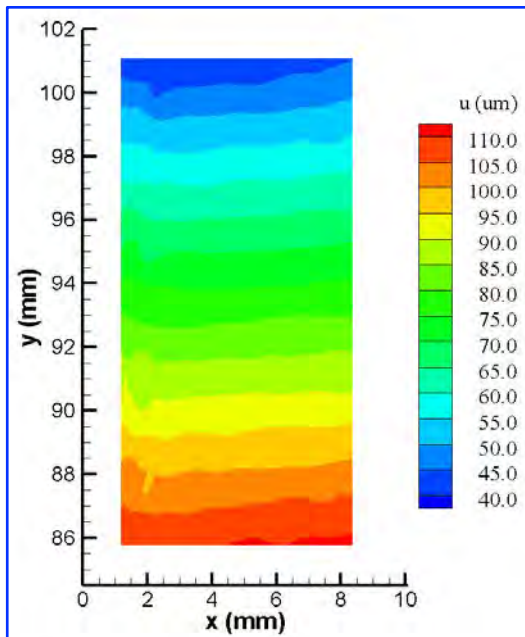
Constitutive Response

DIC / Synthetic Data from forward problem



Failure property extraction

- Experiments:



Failure property extraction

- Inverse problem: Unconstrained, derivative free Nelder-Mead algorithm

$$(\mathbf{K}_b(\mathbf{u}) + \mathbf{K}_{\text{coh}}(\mathbf{u}, \lambda_{\text{coh}})) \cdot \mathbf{u} = \mathbf{F}^{\text{ext}}$$

Nelder-Mead Optimization

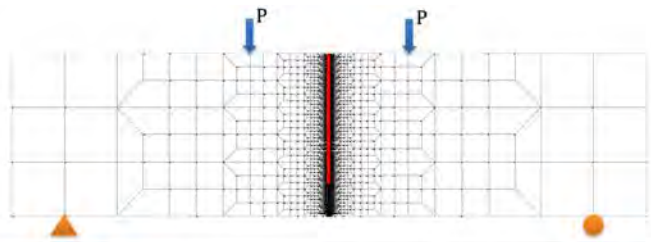
$$\min_{\lambda} \Phi(\lambda) = w_1 \|\mathbf{F}^{\text{ext}} - \mathbf{F}^{\text{int}}\| + w_{f_1} f_1(\alpha), \quad \Phi: \mathbb{R}^3 \rightarrow \mathbb{R}$$

λ = Cohesive Parameters

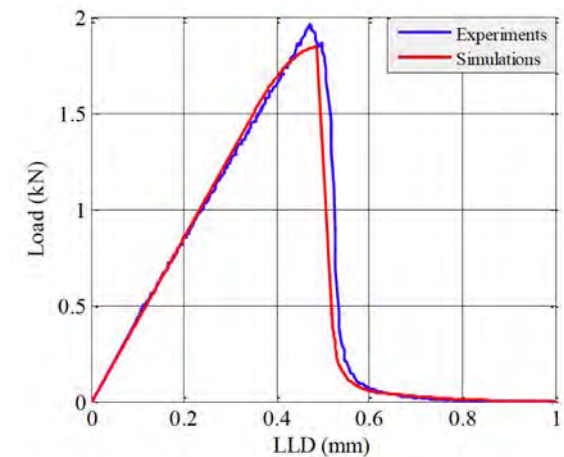
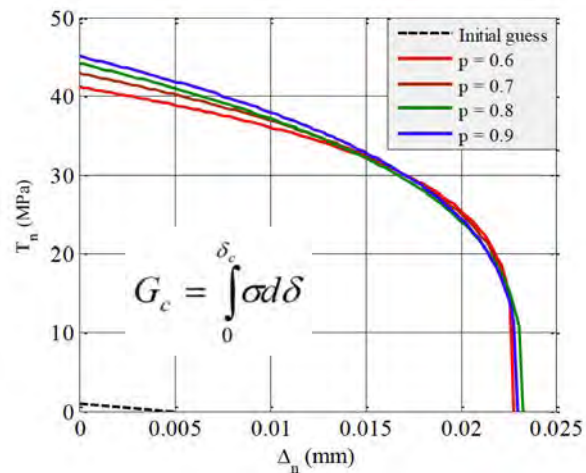
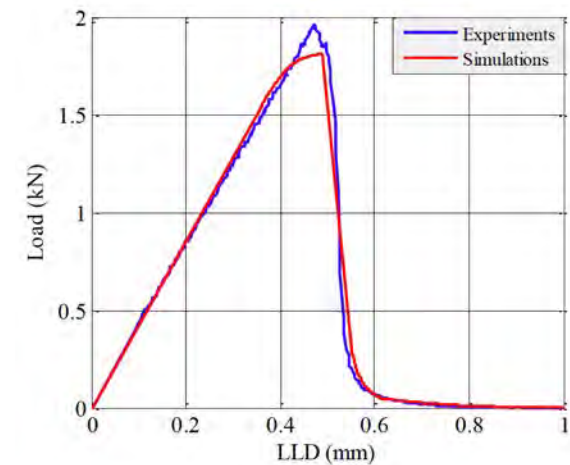
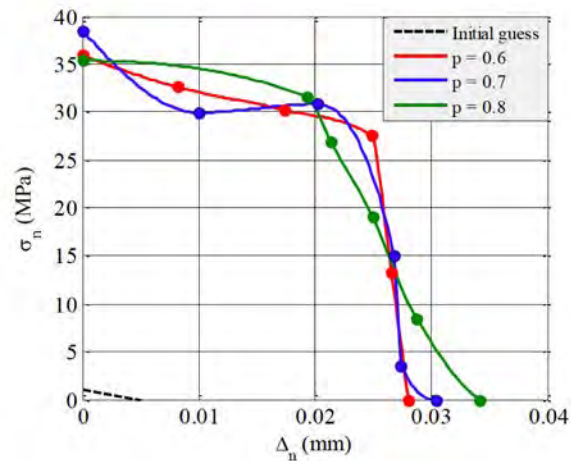
$$= \{\phi_n, \sigma_{\max}, \alpha\}$$

Constraints: $\alpha > 1$

Barrier Function:
$$f_1(\alpha) = \sum_{\psi \gg 1} 10^{\psi(1-\alpha)},$$



Gain et al., *Int. J. of Fracture*, 2011



Outline

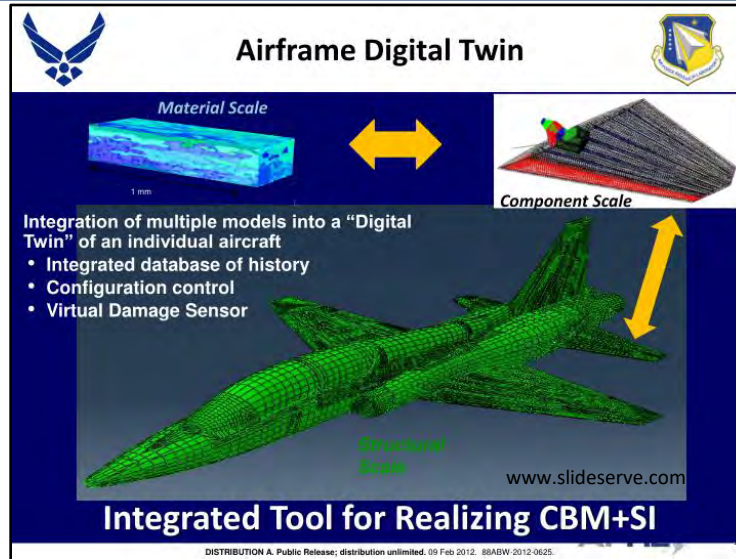
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- **Boundary measurements:**
 - Dynamic shear cracking
- **Cohesive properties:**
 - Full-field measurements
 - Inverse problem extraction
- **Coupled problem: Thermoacoustic fatigue**
 - Image decomposition methods

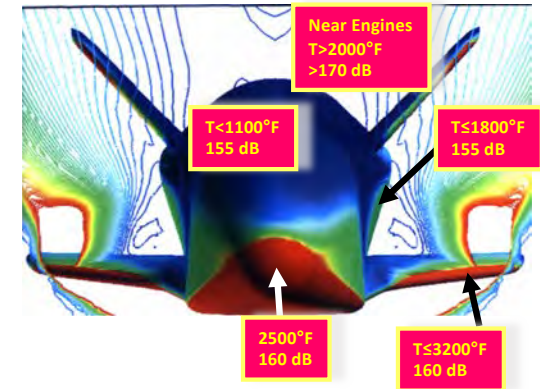


Thermoacoustic fatigue

- Motivation:



Reusable space access



Exhaust wash structures



aviationweek.com

