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Mitigation of Fatigue Failure from Erosion Damage

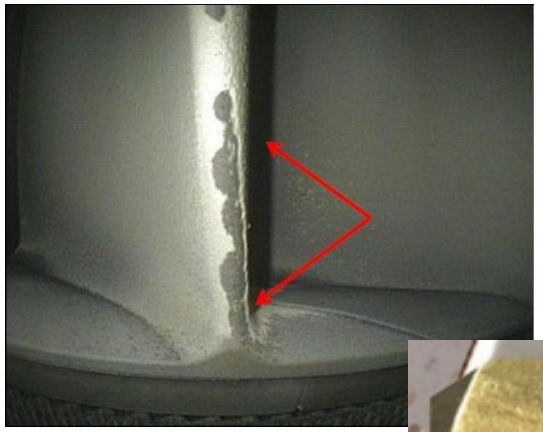
Cost-Effective Life Extension for Gas Turbine Engines

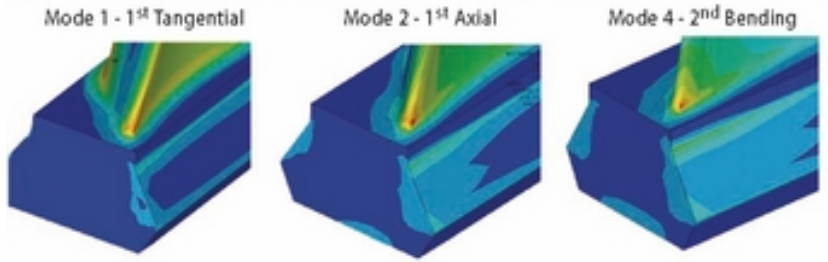
Supported by:

LAMBDA Technologies Group

Detrimental Effects of Erosion Damage

- Caused by particle or water droplet impingement on edges of blades and other airfoils
- Typical limiting erosion damage: <0.01 inch (0.25 mm)
- Appears as pits or grooves on the airfoil edges





Consequences

- Fatigue cracks initiate from erosion pits
- Premature retirement of blades and rotors
- Potential catastrophic failure
- Frequent Inspection

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Erosion related damage tolerance requires frequent inspection, blending, and costly downtime.

Common Treatments

- Minimize sand or moisture ingestion into the turbine engine through changes in design or operations – changing engine design or operations could be cost-prohibitive
- Frequent inspection for erosion damage – very difficult for components with low damage tolerance; limitations on frequency and difficulty of inspection
- Blending the erosion damage to remove stress concentration – Engine downtime, reduced operation efficiency
- Use of hard coatings like Co-WC – local breakdown of coatings exacerbates the problem
- Replace parts frequently – Increases total ownership costs

These treatment methods aim to minimize effects of erosion damage with varying degrees of success.

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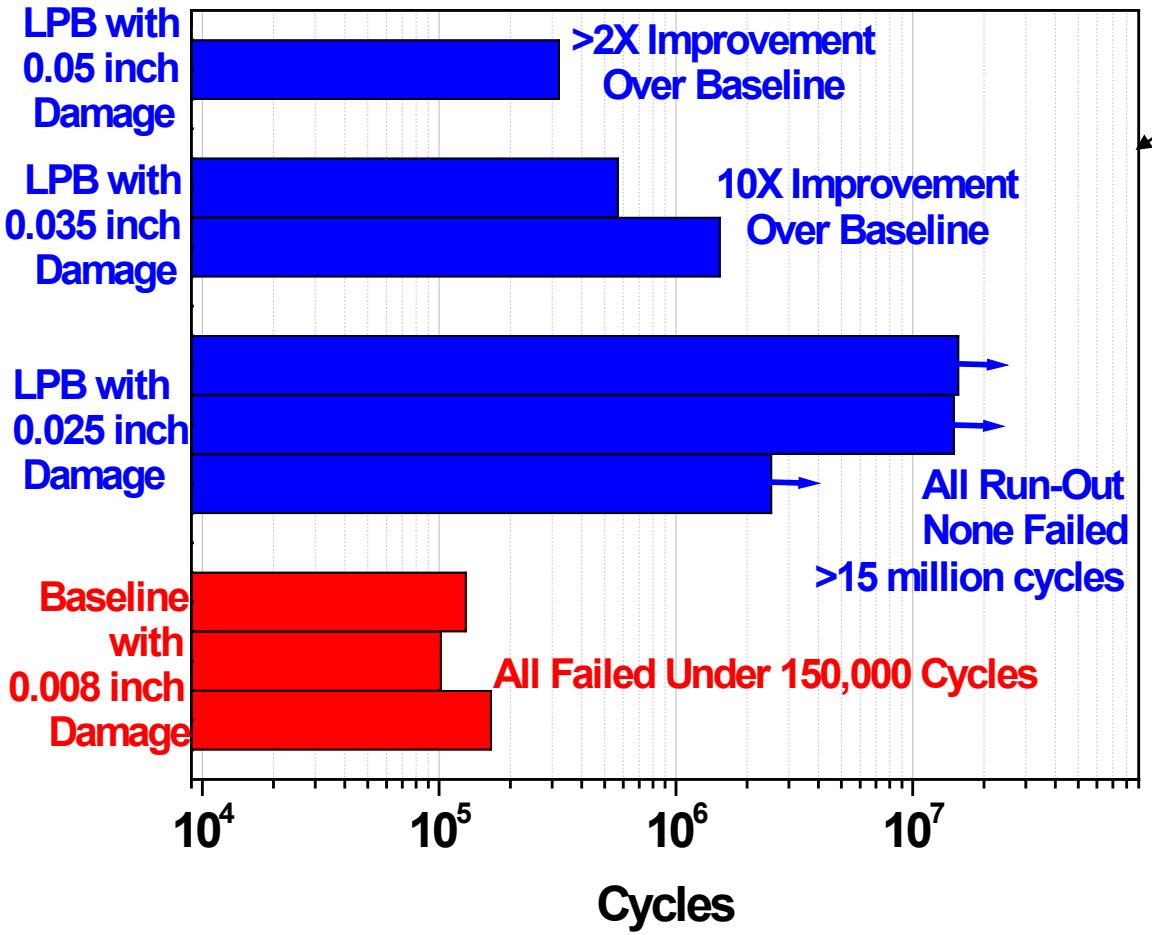
Designed Compression



Designed Compression Applied to GE 7F R0 Blades for Erosion Mitigation

Benefits

- Extend Component Life
- No Material Replacement
- No Redesign
- Improve Damage Tolerance
- Reduce Risk of Failure
- Improve Cost Savings

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Improved Damage Tolerance
Cost-Effective Life Extension for Gas Turbine Engines