National Aeronautics and Space Administration

Materials and Coatings

Improved Infrared Contrast Analysis and Imaging

for NDE of Advanced Nonmetallic Structural Composites

Researchers at NASA's Johnson Space Center (JSC) have developed novel techniques for post-processing of flash IR thermography data, providing efficient and cost-effective enhancements to Non Destructive Evaluation (NDE) of structures for a myriad of applications. Compatible with commercial IR thermography products, this suite of tools provides both quantitative and qualitative data analysis capabilities and reliable detection and characterization of anomalies in composite structures. Calibration techniques provide detailed, systematic analysis of flash thermography data comparable to that used in advanced pulse/echo ultrasonic testing, offering accuracy not currently available for NDE of composite materials.

This NASA Technology is available for your company to license and develop into a commercial product. NASA does not manufacture products for commercial sale.

BENEFITS

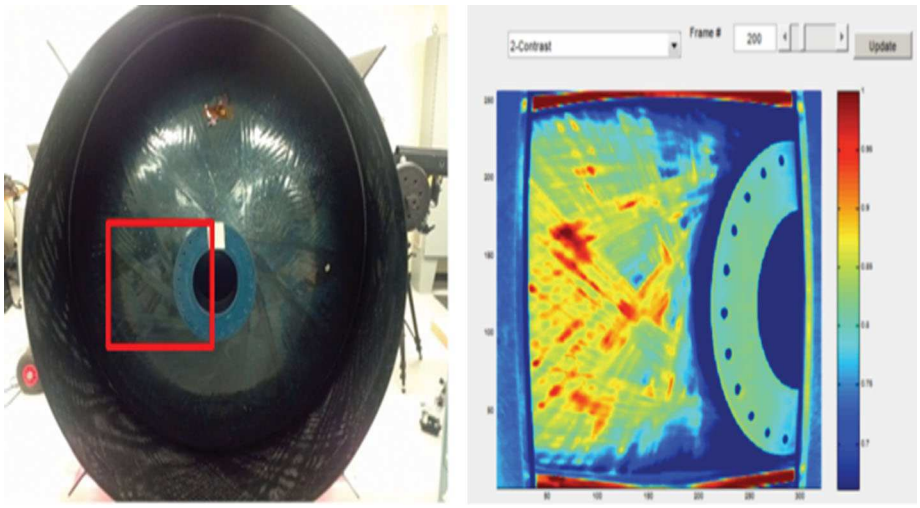
- Comprehensive: Provide enhanced quantitative and qualitative data about flaws
- Efficient: Extracts and constructs images quickly and with ease
- Competitive: Precise characterization of flaws in nonmetallic composites
- Cost-effective: Compatibility with existing flash thermography hardware systems
- Accurate: Improve signal-to-noise ratio and flaw detection sensitivity
- Efficient - extracts and constructs images quickly and simply, saving operators the chore of manually sorting through stacks of images, enabling swifter and more accurate evaluation of thermographic data

technology solution

THE TECHNOLOGY

When using flash IR thermography to evaluate materials, variations in the thermal diffusivity of the material manifest themselves as anomalies in the IR image of the test surface. Post-processing of this raw IR camera data provides highly detailed analysis of the size and characterization of anomalies. NASA created complementary contrast tools that offer highly precise measurements.

The peak contrast and peak contrast time profiles generated through this analysis provide quantitative interpretation of the images, including detailed information about the size and shape of the anomalies. The persistence energy and persistence time profiles provide highly sensitive data giving indications of the worst areas of the detected anomalies. Peak contrast, peak time, persistence time, and persistence energy measurements also enable monitoring for flaw growth and signal response to flaw size analysis. The normalized temperature contrast profile provides more sensitive response than image contrast, allowing the system to detect smaller flaws. JSC's suite of software and tools provides more comprehensive, detailed, and accurate NDE detection and characterization of subsurface defects in nonmetallic composite materials than current methods. JSC's software normalizes and calibrates the data, therefore, providing more stable measurements and greatly minimizing errors due to operator and camera variability.



1: Allows for analysis of data in a manner that is similar to pulse/echo ultrasonic testing, making it familiar to technicians

APPLICATIONS

The technology has several potential applications:

- This suite of tools can be applied to NDE using flash IR thermography of any nonmetallic advanced structural composite, such as those used in myriad industries:
- Aerospace - aircraft and fuselage structure, airfoils, turbine blades
- Power generation - turbine blades, pipelines
- Chemical and petrochemical - pipelines, fuel tanks
- Marine - marine vehicle bodies, fuel tanks, pressure vessels
- High-performace automotive - racecar bodies and structures
- Construction - bridges

PUBLICATIONS

Patent No: 8577120; 9066028; 9787913; 10332248; ; 10242439

More Information

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Agency Licensing Concierge

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