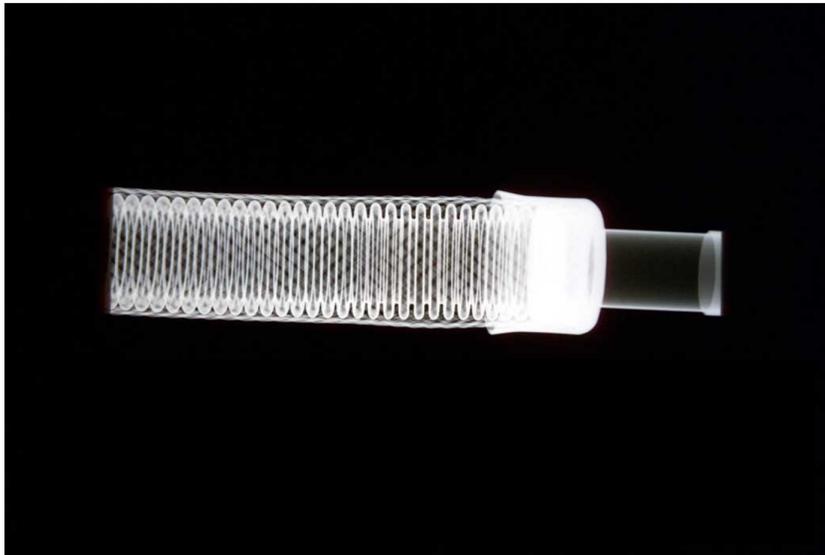




TECHNOLOGY SOLUTION

Aerospace



X-Ray Crack Detectability

[Software optimizes X-ray radiography setups for crack sensitivity verification](#)

Innovators at NASA Johnson Space Center have developed flaw size parameter modeling to determine if a specific X-ray setup can detect cracks of various sizes within materials. These models allow users to optimize X-ray radiography setups, for the detection of crack and crack-like flaws, to penetrate various materials to show internal structures such as the threaded pipe shown above. The ability to quantify crack detection sensitivity paves the way for crack detection requirements to be defined for X-ray radiography nondestructive evaluation (NDE) of manufactured parts. Improved industry requirements for reliable crack detection using x-ray radiography and improved X-ray setup optimization tools that are based on software modeling, such as this technology, may be desired by industry.

The Model-Based X-Ray Crack Detection Requirements is a technology readiness level (TRL) 6 (system/sub-system model or prototype demonstrated in an operational environment). The innovation is now available for your company to license. Please note that NASA does not manufacture products itself for commercial sale.

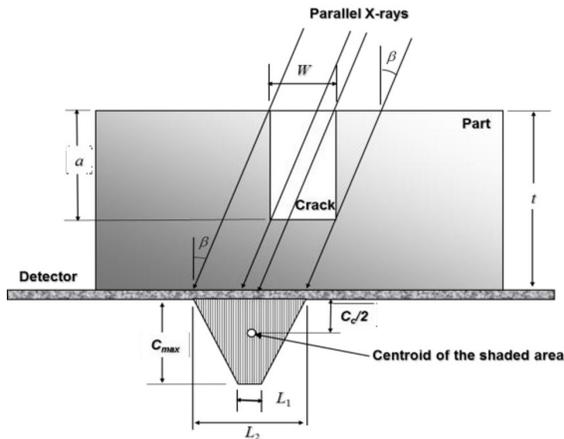
BENEFITS

- Characterizes crack detection capabilities
- Enables development of crack detection requirements/standards
- Optimizes X-ray radiography test setups
- Inexpensive to operate



THE TECHNOLOGY

NASA's software technology uses an Image Quality Indicator (IQI)-based model that can predict whether cracks of a certain size can be detected, as well as a model that can provide appropriate conditions to optimize x-ray crack detection setup. Because this modeling software can predict minimum crack sizes that can be detected by a particular X-ray radiography testing setup, users can test various setups until the desired crack detection capabilities are achieved (predicted) by the modeling system. These flaw size parameter models use a set of measured inputs, including thickness sensitivity, detector modulation transfer function, detector signal response function, and other setup geometry parameters, to predict the minimum crack sizes detectable by the testing setup and X-ray angle limits for detecting such flaws. Current X-ray methods provide adequate control for detection of volumetric flaws but do not provide a high probability of detection (POD), and crack detection sensitivity cannot be verified for reliable detection. This results in reduced confidence in terms of crack detection. Given that these cracks, if undetected, can cause catastrophic failure in various systems (e.g., pressure vessels, etc.), verifying that X-ray radiography systems used for NDE can detect such cracks is of the utmost importance in many applications.



Schematic of a crack flaw in a manufactured metal part.

APPLICATIONS

The technology has several potential applications:

- Industrial X-ray radiography
- Aerospace manufacturing
- Gas and oil pipeline manufacturing
- Gas turbine manufacturing
- Medical implant and prosthetic manufacturing

PUBLICATIONS

Patent No: 11747287; 11841333

Patent Pending

technology.nasa.gov

More Information

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