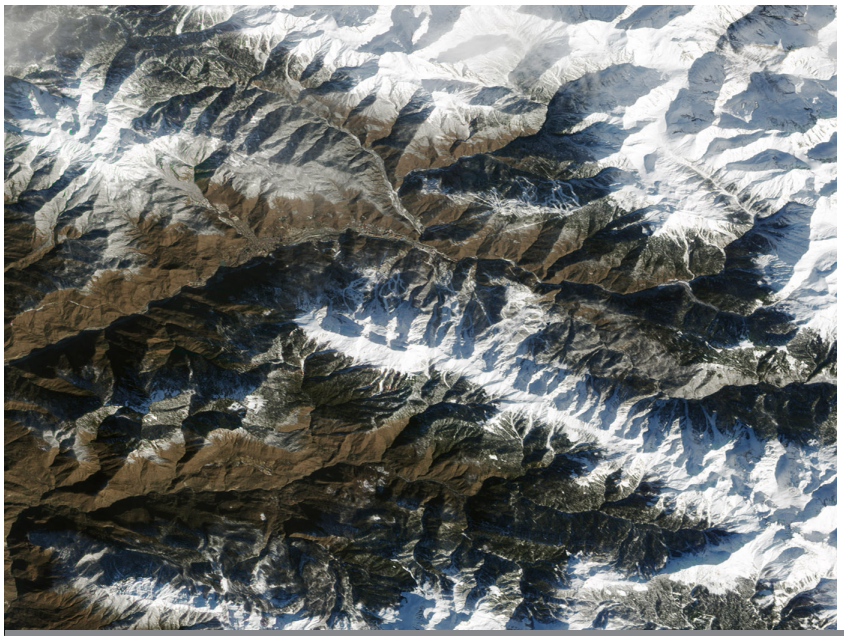

National Aeronautics and Space Administration

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TECHNOLOGY SOLUTION

Manufacturing

Pyramid Image Quality Indicator

A scalable, inexpensive tool and methodology to ascertain real life computed tomography system performance for a wide range of industrial applications

Image quality indicators (IQIs) and known defect standards for industrial 2D x-ray radiography have been used in practice for many years. However, universally accepted standards for 3D x-ray, also known as computed tomography (CT), do not currently exist. Customary IQI devices for 2D radiography are typically flat; however, since CT data is inherently volumetric, flat objects offer an unrealistic basis for a standard. Many known CT IQIs are known as disc phantoms and intended for medical inspection purposes or defines resolution based on the modulation transfer function calculated across the exterior edge of a round coupon. While this may be sufficient for an indirect and relative assessment, the image sharpness of the exterior edge may be not representative of interior boundaries and only serves as an indirect measure. These IQIs are also not ideal for capturing actual system performance under real life, application-defined settings. For industrial applications of CT, an IQI should be able to accommodate a much broader range of possible scan settings. The Pyramid Image Quality Indicator is designed specifically for CT data and which can be modified to accommodate a wide range of applications.

BENEFITS

- Easily scalable for size requirements
- Cost-effective

THE TECHNOLOGY

The Pyramid Image Quality Indicator is based on the shape of a tall, 4-sided pyramid. Each side of the pyramid has a pair of vertical trenches which draw closer to each other and get narrower as they approach the tip of the pyramid. Inside the pyramid is a hollowed out conical section which may contain internal features for determining resolution or inserts that can be used for measuring contrast sensitivity. The system can be economically 3D printed and then coated, if need be, with high x-ray absorbing material. When a CT system operator is scanning a part, a specific method for that part which might include a large number of variables such as x-ray voltage, detector-to-source spacing, pixel size, etc. This established method will result in an effective level of detail for the resulting scan. The IQI is used to measure that level of detail. The operator may follow up the scan of the part with an identical scan of the IQI, which will allow a realistic measurement of parameters, like effective resolution or contrast sensitivity.

The interior of the Pyramid IQI uses a 3D variant suited for 3D CT scan data tools, known as penetrameters. These penetrameters are a solid disc of material. A stack of discs of different diameters would accommodate a range of different thicknesses. The Pyramid IQI can be easily scaled for either larger or smaller parts. It can also be 3D printed using either plastic or metal additive manufacturing. This allows an end-user to match the material density of the IQI to that of the actual part.

APPLICATIONS

The technology has several potential applications:

- Non-destructive evaluation
- Manufacturing quality control
- Medical x-ray equipment manufacturing

PUBLICATIONS

Patent No: 11170500

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NASA's Technology Transfer Program pursues the widest possible applications of agency technology to benefit US citizens. Through partnerships and licensing agreements with industry, the program ensures that NASA's investments in pioneering research find secondary uses that benefit the economy, create jobs, and improve quality of life.

GSC-18220-1, GSC-TOPS-250

More Information

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FS-2019-11-478-GSFC