Z4.05-2122 - Laser Ultrasonic Testing for Defect Correction during In-Space Additive Manufacturing

PI: Bradley Bobbs , Intelligent Optical Systems, Inc. - Torrance, CA

NON-PROPRIETARY DATA

IDENTIFICATION AND SIGNIFICANCE OF INNOVATION

A key advantage of additive manufacturing (AM) is the opportunity for in-line, in-situ, real-time detection, identification, and correction of defects. NASA safety-critical parts in particular require testing to certify the absence of critical defects that compromise mechanical performance. If this can be done in-line, the need for scrapping finished defective parts is removed.

Laser ultrasonic testing is the only currently viable evaluation method that can be performed in-line during the AM build. Its noncontact nature enables it to operate on hot, rough, moving, vibrating surfaces, while quickly moving along the surface. This gives close access to defects for sensitive detection, and so corrective measures can be taken, often during the following build layer, before they are covered over by further deposition.

Our previous work has addressed the application of laser ultrasonics to detect defects in AM parts made on Earth. The proposed project extends that work to AM parts made in space.

TECHNICAL OBJECTIVES AND PROPOSED DELIVERABLES

The technical objectives will include 1) Demonstrate feasibility of integrating an in-line LUT system into an AM machine for in-space applications; 2) Demonstrate feasibility of LUT and software data analysis tools to detect and identify defects in-line during AM parts fabrication in space; 3) Demonstrate feasibility of correcting LUT-detected defects during an in-space AM build; 4) Develop initial low-SWaP-C LUT design for in-space AM build monitoring.

The deliverable will be a concept study documenting the demonstrated feasibility and value of incorporating an LUT sensor into an AM machine designed for in-space use.

TRL

Estimated

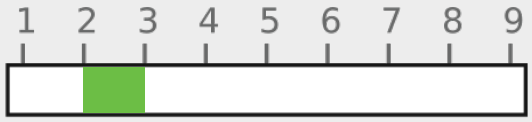
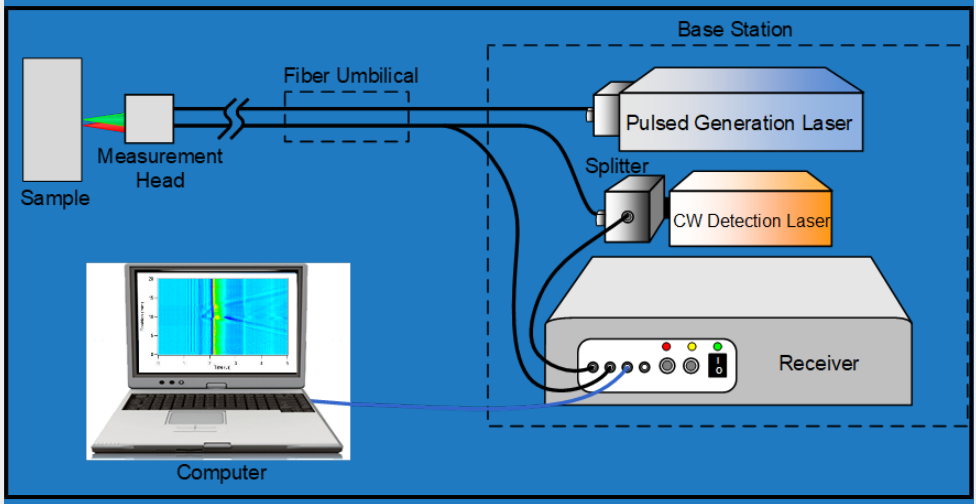


IMAGE TITLE: Laser ultrasonic testing



NASA APPLICATIONS

An in-line LUT inspection system will enable the production of fully qualified AM parts on the surfaces of the Moon and Mars, to support sustainable exploration there, as well as on the International Space Station.

NON-NASA APPLICATIONS

An LUT system miniaturized for in-space use will also find utility in industrial applications where space and power are limited, or where greater portability is desirable. Equipment cost is also expected to be greatly reduced for such a system. The introduction of in-line, real-time laser ultrasonic testing for AM supports Executive Order 13329, "Encouraging Innovation in Manufacturing."

FIRM CONTACTS

Bradley Bobbs
Intelligent Optical Systems, Inc.
EMAIL: bradb@intopsys.com
PHONE: (424) 263-6326