NASA Langley's
Crimping Tool for Safe and Efficient Critical Wiring Needs

Tool connects wires to end-connectors and nondestructively verifies crimp quality during the crimping process

NASA Langley researchers have developed an enhanced crimp tool that provides real-time verification of wire-crimp integrity while the crimp is being formed. The tool nondestructively tests crimp connection quality in aircraft and other critical wiring systems. Modern commercial aircraft rely on thousands of crimped wire terminations for critical communication, navigation, control, and electrical power distribution systems. Wiring crimp failures can be a threat to aircraft safety and may lead to a loss of critical functions or an onboard fire. In addition to the safety concerns, diagnosing and repairing poor crimp connections is costly. By enabling an efficient way to directly test all crimps as they are made, the new tool improves quality control and reduces the risks of failure.

Benefits

- Improved quality control: Enables direct and practical testing of all crimp connections, compared to current procedures that rely on a combination of a rigorous crimp protocol and periodic spot checks to destructively evaluate representative crimps
- Improved safety: Allows direct testing of all crimp connections as they are made
- Reduced costs: Lowers risk of failed crimp connections that are costly to replace
- Real-time confirmation of crimp integrity

partnership opportunity

Figure 3: Prototype instrumented crimp tool

Applications

This technology can improve safety and reduce costs related to installing and/or overhauling crimp/wire connections in industries with critical wire terminations, such as:

- Marine
- Automotive
- Industrial plants
- Nuclear power plants
- Medical devices

The Technology

The tool is based on traditional ultrasonic nondestructive evaluation methods. The quality of the contact between the connector and wire is determined by sending an acoustic wave through the crimp assembly. Figure 1 depicts the interrogation of a crimp connector. As the applied pressure increases and the crimp terminal deforms around the wire, the ultrasonic signature passing through the crimp is altered. The tool analyzes the changes in the signal, including the amplitude and frequency content, as an indication of the quality of both the electrical and mechanical connection between the wire and terminal.

Figure 2 shows the ultrasonic response of a crimped connector. Various crimp quality issues such as undercrimping, missing wire strands, incomplete wire insertion, partial insulation removal, and incorrect wire gauge have been tested using this technique, and results show that the instrumented crimp tool consistently discriminates between good and poor crimps for all of these potential quality issues. This information can be used to provide a "pass" or "fail" indication to the technician for instant verification of the crimp quality and to give a better prediction for the service life of the crimp.

The system has been prototyped and tested and is in use at NASA. Figure 3 shows the prototype instrumented crimp tool.

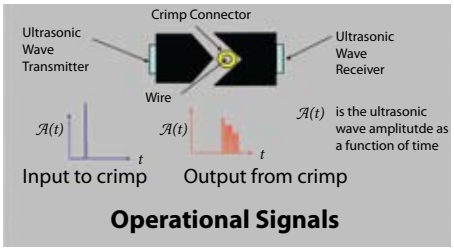
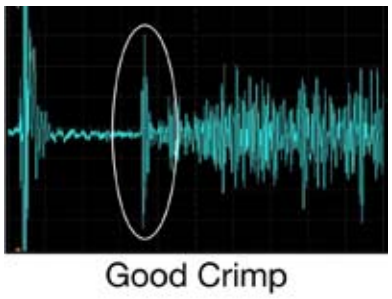


Figure 1: Basic concept of ultrasonic equipped crimp tool



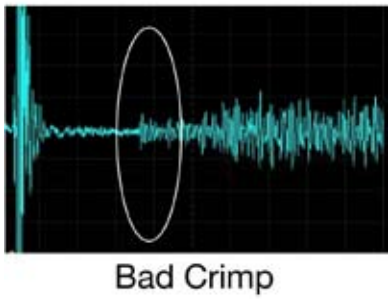


Figure 2: Ultrasonic response of a crimped connector

For More Information

If your company is interested in licensing or joint development opportunities associated with this technology, or if you would like additional information on partnering with NASA, please contact:

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