INFORMATION

AEROSPACE MANUFACTURING TECHNOLOGY

Surface Finishing and Treatment

The NRC Institute for Aerospace Research (NRC Aerospace) has the expertise and facilities to help industry develop intelligent surface treatment and finishing technologies for manufacturing and maintenance operations.

Visual servoing
Aerospace manufacturing applications such as robotic drilling and riveting, shot peening and peen forming, surface finishing (deburring, polishing, grinding), and welding all require accurate robot positioning. Current industrial robot controllers, however, lack the accurate positioning required for these applications. To improve the situation, NRC Aerospace is developing an integrated, visual positioning system linked to a robotic system. Visual servoing of a camera mounted on a small robot is achieved through algorithms that reconstruct real-world coordinates from image coordinates and transforms them so that the robot arm remains on target as it moves around the object. A laser pointer provides the coordinates for the system.

Intelligent robotic surface finishing
NRC Aerospace is also developing intelligent robotic surface finishing applications, such as sanding and polishing, using through-the-arm (in which force is generated through robot arm motion) and around-the-arm (in which force is generated locally by an active force device) approaches. The robots used for these applications are equipped with a force sensor and camera (or laser range finder), and an intelligent task planner that adjusts applied force to surface hardness.

Intelligent surface treatment
Work is currently underway on the design and prototyping of a robot-assisted system for controlled shot peening to enhance its accuracy and repeatability, and to reduce human health hazards. Shot peening is a method of cold-working the surface of structural parts that involves shooting small, cast iron, steel, glass or ceramic beads at high speed at the part. It increases the fatigue life of mechanical aircraft components by introducing residual compressive stress into the surface layer of the part.


Examination of shot peening specimen

The technology is being applied to the F18 aircraft life extension in a collaborative project with Canada's Department of National Defence and two Canadian companies, L3 Com and ESI. NRC Aerospace has already developed a unique system for the process that integrates mass flow control and velocity control. It is now characterizing and modeling the shot peening process in order to develop a fully integrated robotized shot peening process based on flexible tooling.

Intelligent wing and control surfaces manufacturing
NRC Aerospace also carries out studies on automated peen forming of wing structures. The process involves confining steel beads between two surfaces and then

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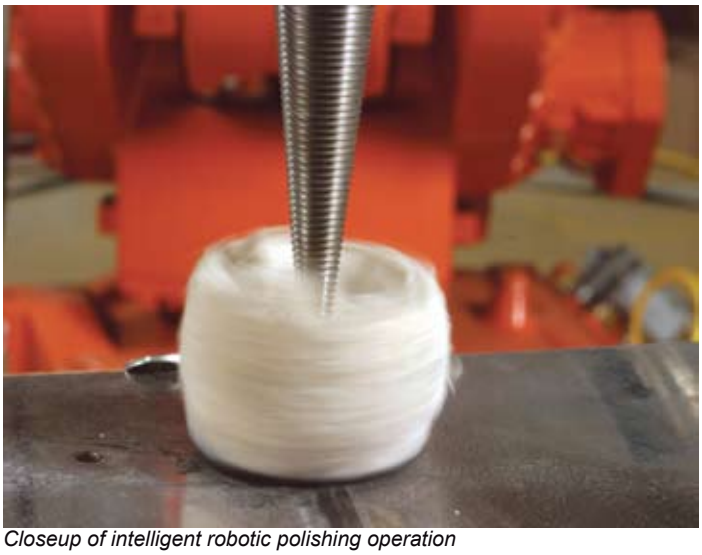

Closeup of intelligent robotic polishing operation

vibrating them using ultrasound while moving across the surface of the part. The technology reduces costs because it uses only small quantities of recyclable beads. It is also environmentally friendly. Current investigations include identification of process parameters, characterization and modeling of work piece behaviour, development of control mechanisms and process optimization. A project with Sonaca/NMF is underway to develop and implement a technology demonstrator for peen forming. Researchers are also investigating ultrasound peening in a collaborative project with SONATS.

Equipment

- Baiker shot peening machine with closed loop media flow control
- Shot meter: particle velocity measurement systems
- SONATS StressSonic system for ultrasound peening
- Creaform laser scanner system for peen formed shape measurement
- Motoman SV3X and UPJ robots.

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