Innovation for robotic drilling – Passive input gearbox

Engineers in the Advanced Manufacturing Research Centre's (AMRC) new Design & Prototyping Group have developed a compact gearbox for an innovative robotic drilling system. Using maxon motor's EC-4pole brushless DC motor the automated system can quickly adjust its parameters when drilling complex aerospace structures containing both metal and composite materials.

The latest aircraft use an increasing amount of carbon fibre and other composites. By using these lightweight materials instead of metals, aircraft can be made lighter and more fuel efficient. In some applications where extra structural strength is required, layers of composite are stacked with layers of titanium or aluminium alloy. Often, such a layered stack has to have holes drilled through it so that fasteners can be attached.

These composite and metallic materials have very different material properties and would normally require different drilling parameters. For example, drilling a carbon fibre composite commonly requires high speed and low torque, while drilling titanium typically requires low speed and high torque. Drilling a hole through a stack of both materials demands a tool which can quickly and efficiently switch between these two modes.

Designing such a tool is made more complicated by the fact that they often have to be deployed in confined spaces, such as within wing boxes or engine intake ducts. maxon motor's EC-4pole brushless motor proved to be ideal for this project, manufactured in a 22 mm and 30 mm version its high power density and speeds of up to 25,000 rpm make it ideal for high performance drill applications. Senior Sales Engineer Paul Williams at maxon commented, 'The brushless motor with MR (magnetic reluctance) encoder allows the customer to quickly control the exact speed and torque on the drill; AMRC innovative 2 speed gearhead allows high speed drilling with low torque and to high torque low speed to meet the different drilling parameters within one drill tool.'

Researchers at the AMRC with Boeing have previously developed flexible robots carrying lightweight tools to do essential tasks in such awkward spaces, including a confined space drill.

The challenge fell to the AMRC's new Design & Prototyping Group as part of an project backed by Boeing. The project was led by senior design engineer Dr Garth Nicholson.

"Our solution was what we have called a passive input gearbox, which automatically changes gear ratios depending on the rotation direction of the drive motor, while always maintaining the same drill rotation direction," *says* Dr Nicholson. "Its design was particularly demanding because we had to fit it onto our existing confined space drill. It had to be as small and light as possible, while still covering a wide range of output speeds."

The assembled gearbox is now being evaluated at the AMRC. Following successful tests with the drill motor, the gearbox is now being integrated into the confined space drill chassis. Full test programs will trial the different options for material detection and investigate the process capability of the whole system for stack drilling.

Further information can be found www.amrc.co.uk/research/design/, and on YouTube www.youtube.com/watch?v=LRXy1p7-baI. Garth can be contacted on g.nicholson@amrc.co.uk.

About maxon motor

maxon motor is the world's leading supplier of DC motors, brushless motors, gearheads and controllers. We offer high quality, innovation, competitive pricing and highly specialised solutions.

Where are maxon motors used today?

Aerospace
Robotics
Medical science
Industrial automation
Instrumentation & inspection
Communication
Surveillance cameras
Automotive
Consumer applications

maxon's motors, gearheads, encoders, brakes and controllers are all perfectly compatible and offer an almost unending number of possible combinations. The maxon modular system gives the ideal combination for the required application.

For additional information, contact:

Karen Whittaker
Marketing
maxon motor uk
Maxon House
Hogwood Lane
Finchampstead
Berkshire RG40 4QW

Telephone +44 (0)118 973 3337
Fax +44 (0)118 973 7472
Email karen.whittaker@maxonmotor.com
Web www.maxonmotor.co.uk