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Heady Times for High-Feed Milling

New technology boosts tried and true process

High-feed milling (HFM) has been used for years to achieve high metal-removal rates, increase productivity and decrease workpiece cycle time. The roughing process—applicable for both solid-carbide and indexable insert tools— combines a shallow depth of cut (DOC) with a large cutting radius and small lead angle to ensure that the cutting forces are directed axially towards the machine spindle. It allows feed rates up to 10 times higher than normal rough milling.
Why should part manufacturers consider implementing HFM or, if they are already using the technique, consider more advanced HFM technologies?

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HFM's ability to reduce cycle time in hard materials or 3D shapes with tapered walls and/or curved surfaces is a key factor, according to Alyssa Walther, applications engineer, OSG USA Inc. (Glendale Heights, IL). "High-feed milling is also excellent at minimizing radial deflection, which will positively impact parts that require long reach from the tools," she said.

Different Tools

Cutting tools required for high-feed milling differ from standard milling tools in several ways. Typically, a high-feed tool has a lead angle of 10-20° from the surface being machined, according to Martin. This lead angle helps thin out the chip and allows for much higher feed rates than conventional style cutters. Walther added that HFM tools have either a very large corner radius or a specific "cutting angle" ground into the end face of the tool or insert. "At small DOCs, either configuration allows for smaller true chip loads, which in turn allows higher feed rates," she said.

Holding True

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HFM cutters can actually provide assistance to some clamping systems, according to Walther. "Since cutting forces are mainly directed along the centerline axis of the tool, and towards the direction of the spindle, this creates a very stable and vibration resistant machining environment," she said. "It is an excellent option for weak clamping situations."
However, as with any milling application, the stronger the hold on the tool and the truer the holder keeps the tool on center, the better the tool will run. "Typically, mill chucks and hydraulic holders are 'beefier' holders and offer the best rigidity, excellent holding strength, and as such, natural vibration dampening," said Walther. "While shrink-fit holders aren't typically as robust as a mill chuck or hydraulic holder, they have excellent holding force on the tool shank and offer high runout precision."

Machine Tool Requirements

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Walther added that, without good look-ahead software, circular shapes will be misinterpolated into polygons. "Machines with stronger and faster acceleration capabilities are also more beneficial for smaller workpieces."

Work Materials and Tool Selection

New Technology for High-Feed Applications
As in other areas of machining, recent advances in tooling technology is making HFM more productive and more efficient.

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While the basic features of high-feed cutters remain the same, tool substrates, coating technologies and grinding technologies continue to improve, according to Walther. Features that improve chip shape, chip control and surface finish are also important advances. “For example, the new OSG HFC-Ti solid-carbide high-feed end mill is designed not only for extremely high feed rates, but for simultaneously floor finishing in titanium alloys,” she said. “The OSG PHC high feed indexable cutter has insert grades XP2040 for stainless steels and XC5040 for heat-resistant superalloys. These inserts are optimized at their cutting edge geometry, substrate and coating for just such materials.”

Information provided by OSG USA, Inc.
800-837-2223 / www.osgtool.com