Special light milling head produced by 3D metal printing

The major advantage of this new generation milling head is the radical reduction of the weight by more than 50% versus standard cutting tools. Final mechanical stability is similar to the full volume body milling head. A further advantage is the possibility of using a special internal cooling system for the clearance and rake faces of the cutting inserts, as in this case.

The cutting tool is used as a universal tool for all machined materials. Inconel 718 was used for the long-term tests, where the real strength and stiffness were verified and the benefits of the internal cooling system were confirmed. The next materials to be tested are austenitic steel and aluminium alloy. On the basis of these tests, the cutting tool stability will be confirmed when using high speed machining.

Cutting tool specifications

- Tool diameter: 125 mm
- Tool weight: 1.01 kg
  (standard is more than 3 kg)
- High cutting stability
- Special cooling system for rake and clearance face
- Higher surface quality
- Usable for HSC and Ultra Speed
- Machining or for hard to machine materials
To verify the milling strength and stiffness, FEM analyses were made and the weak points were optimized. After these analyses, the cutting tool was printed and tested. Firstly modal analyses, material analyses and stability analyses were carried out, and subsequently a long-term test was conducted.

Benefits of the new cutting tool construction

When additive manufacturing technology is used for the production, it is possible to reduce tool weight by more than 50%, and optimise the internal cooling system for the rake and clearance faces which provide the following benefits:

- Use of a bigger cutting tool diameter than is normally possible
- Increasing the cooling liquid speed or change of cooling principle (sputtering)
- Increasing the cutting tool life
- Reducing the energy intensity of the machining process
- Improving the workpiece surface integrity (roughness, stress, accuracy)
- Increasing the machine spindle safety and serviceability
- Shortening the cutting tool production times
- Reduction of the total machining costs
- Simple tool rebuilding

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