

Abstract of the paper

Paper title: **Characterization of the cutting phenomenon in orbital drilling of titanium alloys (TiAl6V4)**

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Abstract :

The orbital drilling, also called helical milling, is a process notably used in the aeronautical industry. It is very different from the axial drilling. It consists in machining a hole with a tool which has a smaller diameter, driven on a helical trajectory. This process is used especially because it generates low cutting forces. As a consequence, the burr formation at the entry and at the exit of the hole is largely reduced, so as the risk of delamination when drilling CFRP. Operations such as cleaning or deburring are then considerably reduced.

The orbital drilling is a complex operation. Due to the tool trajectory, chip thickness is highly variable along the cutting edges at each tool rotation position. This is why cutting forces are very difficult to estimate.

The aim of this study is to determinate the influence of tool geometry and cutting conditions on cutting forces and on the final quality of the machined holes. At first, the geometry of the chip is modeled taking into account the parameters defining the trajectory and the tool. A cutting force model, based on the instantaneous chip thickness, is then set up. An experimental study validates the cutting force model through measurements of cutting forces during orbital drilling tests, for varying cutting parameters and tool geometries. Dimensional measurements are also realized on drilled holes using a three-dimensional measuring machine. Using cutting force model and the results of tests, it is possible to conclude on the influence of cutting parameters and tool geometry on the hole geometric quality. Then, the optimization of these parameters in order to increase the final quality of the hole is proposed.

Paper type:

Research / ~~application~~

Preferred presentation type:

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