

Analysis of the Cutting Force with Ultrasonic Assisted Manufacturing of Steel (S235JR)

Authors : Philipp Zopf, Franz Haas

Abstract : Manufacturing of very hard and refractory materials like ceramics, glass or carbide poses particular challenges on tools and machines. The company Sauer GmbH developed especially for this application area ultrasonic tool holders working in a frequency range from 15 to 60 kHz and superimpose the common tool movement in the vertical axis. This technique causes a structural weakening in the contact area and facilitates the machining. The possibility of the force reduction for these special materials especially in drilling of carbide with diamond tools up to 30 percent made the authors try to expand the application range of this method. To make the results evaluable, the authors decide to start with existing processes in which the positive influence of the ultrasonic assistance is proven to understand the mechanism. The comparison of a grinding process the Institute use to machine materials mentioned in the beginning and steel could not be more different. In the first case, the authors use tools with geometrically undefined edges. In the second case, the edges are geometrically defined. To get valid results of the tests, the authors decide to investigate two manufacturing methods, drilling and milling. The main target of the investigation is to reduce the cutting force measured with a force measurement platform underneath the workpiece. Concerning to the direction of the ultrasonic assistance, the authors expect lower cutting forces and longer endurance of the tool in the drilling process. To verify the frequencies and the amplitudes an FFT-analysis is performed. It shows the increasing damping depending on the infeed rate of the tool. The reducing of amplitude of the cutting force comes along.

Keywords : drilling, machining, milling, ultrasonic

Conference Title : ICETIME 2017 : International Conference on Emerging Trends in Industrial and Mechanical Engineering

Conference Location : Melbourne, Australia

Conference Dates : November 29-30, 2017