

Development of an Advanced Power Ultrasonic-Assisted Drilling System

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Abstract : The application of ultrasonic vibrations to machining processes has a long history, ranging from slurry-based systems able to drill brittle materials, to more recent developments involving low power ultrasonics for high precision machining, with many of these at the research and laboratory stages. The focus of this development is the application of high levels of ultrasonic power (1,000's of watts) to standard, heavy duty machine tools - drilling being the immediate focus, with developments in milling in progress - with the objective of dramatically increasing system productivity through faster feed rates, this benefit arising from the thrust force reductions obtained by power ultrasonic vibrations. The presentation will describe development of an advanced drilling system based on a special, acoustically designed, rugged drill module capable of functioning under heavy duty production conditions, and making use of standard tool holder means, and able to obtain thrust force reductions while maintaining or improving surface finish and drilling accuracy. The characterization of the system performance will be described, and results obtained in drilling several materials (Aluminum, Stainless steel, Titanium) presented.

Keywords : dimensional accuracy, machine tool, productivity, surface roughness, thrust force, ultrasonic vibrations, ultrasonic-assisted drilling

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