Geometric Model of the Surface Structure Resulting from the Dynamic Milling Process

K. Weinert[1], T. Surmann[1]
[1]University of Dortmund, Department of Machining Technology, weinert@isf.de
surmann@isf.de

Abstract

Besides the prediction of wether a milling process is stable or not, the resulting surface quality is of high importance. Though stable processes produce a smooth surface structure, the absolute contour fault may be high because of high amplitudes of the tool vibration. Experimental results and simulations show that this surface fault is positive (i. e. over measure). Instable processes lead to a low surface quality and chatter marks with a mostly negative surface fault. In the general milling process for free-formed surfaces the engagement conditions change often and rapidly. So, it is hard to control the process parameters in order to optimize the process and the surface quality over a whole NC-program.

This paper presents a geometric model for the construction of the surface structure, which is produced by vibrating milling tools. The tool trajectories, which are calculated by an existing time domain simulation of the dynamic milling process, are analyzed and converted into a model of the machined work piece. For this, a geometric model is applied, which can be visualized photorealistically and analyzed in order to measure the surface fault and roughness. Hereby, the geometric appearance of chattermarks is explained even for twisted cutting tools and the simulation system is verified by the comparison of simulated and real machined workpieces. Furthermore it is shown that the simulation system is able to predict the surface quality, i. e. structure, roughness and fault, which results from the dynamic cutting process, along arbitrary NC-programs with changing engagement conditions.