MANUFACTURING & AUTOMATION RESEARCH CENTER

KOÇ UNIVERSITY

Increasing Productivity in Free Form Machining

In collaboration with

ModuleWorks

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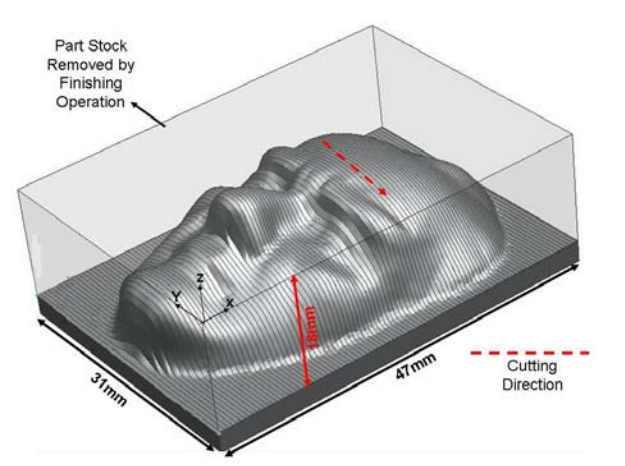
Motivation:

Machining of complex and non-monotonic sculptured surfaces with minimum cycle times has been one of the major priorities in most of the industries such as automotive, aerospace, home appliance and die-mold industries. Reductions in machining times with optimized NC codes are also the targets of CAM software packages developers. This target must be reached without violating the physical limits of the CNC machines such as torque, power, etc, and the limits of the tool due to chipping or breakage as well as the required part quality and tolerances. Considering the CNC machine, tool and workpiece constrains, the process planning engineers in industry practically wish to set maximum limit for cutting force amplitudes all along the tool path.



Currently, the practice in industry, for each set of machining operations, the feedrate is to set a fixed value. Therefore, along the tool path in sculptured surface machining, the feedrate is kept constant, but the force amplitudes are varied. This conventional technique with a constant feedrate is too conservative and time consuming.

Research:

The cutting forces for very complex sculptured surfaces can be precisely predicted. Therefore, rather than using conventional constant feedrate all along the tool path for sculptured surfaces, it is recommended to utilize the new Forced based Feedrate Scheduling (FFS) strategy. In FFS technique, the resultant cutting forces are aimed to be kept constant by varying the feedrate along the tool path. Simulations and experimental validations are performed for non-monotonic complex sculptured surfaces. It is shown that with the new Forced based Feedrate Scheduling strategy; the cycle times of sculptured surface machining are decreased significantly.