dions (depth of cut and cutting speed) on 1018 steel. The experiments show that laser power and depth of cut have a significant effect on the forces in micro grooving of 1018 steel.

MEP-07: Adaptive Raster Cutter Path Scheduling for Free-form Surface Machining
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The accuracy and efficiency of 3-axis computer numerically controlled (CNC) machining using the inverse offset method (IOM) is dependent on the grid sizes, called the step-forward and step-interval distances respectively in the forward and transverse cutting directions. The step-forward distance produces local gouging in the forward direction whereas the step-interval distance produces cusps in the transverse direction. In this paper, an error analysis is carried out with consideration to the slopes and curvatures in the forward and transverse directions and the machined surface error is estimated as a combination of the chordal deviation and cusp height. In contrast with the uniform grid approach, an adaptive grid generation method is proposed, in which different step-forward and step-interval distances are used in different regions in order to limit the machined surface error within a specified tolerance. A machining example is presented to demonstrate the effectiveness of the algorithm.

MEP-08: Dissolution wear: Decomposition of Tool Material, and Concentration Profile into Chip
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The dissolution hypothesis of tool wear is re-phrased as a boundary condition for the transfer of tool components to the chip's bulk via diffusion. In this setting, dissolution wear is defined as the combined events of tool decomposition at the interface and the subsequent mass transfer of decomposed elements into the chip region. Chemical equilibrium is invoked for the distribution of tool species at the tool-chip interface. The Frank-Turnbull mechanism (interaction between interstitial impurities and vacancies to form substitutional impurities) is used as a hypothesis to explain the humped concentration profile of tool constituents into the chip. The humped concentration profile has been found experimentally by Subramanian et al. [4]. The chosen method is semi-empirical in that the interstitial-impurity distribution is solved from a set of coupled, advection-diffusion-reaction equations, whereas the vacancy distribution is constructed so that the final substitutional-impurity distribution agrees with observed data. The present interpretation of the Frank-Turnbull mechanism is illustrated by finite-element simulations.

MEP-09: Effect of Cutting Tip Thickness and Friction Coefficient on Load Characteristic of Trapezoidal Edge Indentation to Aluminum Sheet
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This paper describes a fundamental relationship among a punching resistance, thickness of a cutting tip, and a friction coefficient, for indentation of a damaged edge into an aluminum sheet on a flat rigid plate. It was found that the second inflection point in the resistance curve is a critical depth of the welded sheet. In the subsequent indentation, an assumption of the semi-infinite object cannot be applied due to the relationship between the projected width in contact with the cutting tip and the sheet thickness. A prediction formula depending on the deformation resistance of sheet and on the geometrical conditions was investigated by using the updated, large strain, elasto-plastic finite element analysis. The increase of resistance of the trapezoidal model was approximately same as a sharp wedge model in a certain range of friction coefficient, during the pushed stage.

MEP-10: Critical Depth of Cut and Specific Cutting Energy of a Micro-Scribing Process for Hard and Brittle Materials
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This paper investigated the scribing process characteristics of the hard and brittle materials including single crystal silicon, STV-Glass and sapphire substrate. Under various cutting angles, major process characteristics are examined including 1. the groove geometry, 2. the specific cutting energies and 3. the critical depth of cut at the onset of ductile-to-brittle cutting transition. As the cutting depth increases, groove geometry clearly reveals the ductile-to-brittle transition from the plastic deformation to a brittle fracture state. The material size effect in the ductile region as well as the state transition in scribing behavior are well reflected in the specific cutting energy. The change of specific energy as a function of the cutting depth serves as a criterion for estimating the critical depth of cut. The critical depths of cut for these hard materials are found to be between 0.1μm and 0.5μm depending on the material and cutting angles. Based on the experimental results, a model is set up and calibrated for the given scribing diamond cutter to predict the critical depth of cut for a material with known mechanical properties.

MEP-11: Evaluation of Surface Defects of Railway Wheel using Induced Current Focusing Potential Drop
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The majority of catastrophic wheel failures are caused by surface opening fatigue cracks either in the wheel tread or wheel flange areas. Since failure in railway wheels can cause a disaster, regular inspection of defects in wheels is mandatory. Railway wheels in service are regularly checked by ultrasonic testing, acoustic emission and eddy current testing method and so on. However, it is difficult to use this method because of its high viscosity and because its sensitivity is affected by temperature. Also, due to noise echoes it is difficult to detect defects initiation clearly with ultrasonic testing. It is necessary to develop a non-destructive technique that is superior to conventional NDT techniques in order to ensure the safety of railway wheels. The induced current focusing potential drop (ICFPD) technique is a new non-destructive testing technique that can detect defects in railway wheels by applying an electro-magnetic field and potential drops variation. In the present paper, the ICFPD technique is applied to the detection of surface defects for railway wheels. To detect the defects for railway wheels, the sensor for ICFPD is optimized and the tests are carried out with respect to 4 surface defects each other. The defect detections in railway wheels by using ICFPD was carried out in the azimuthally direction. The result show that the surface crack depth of 1.0 mm and in wheel tread could be detected by using this method. The ICFPD method is useful to detect the defect that initiated in the tread of railway wheels.

MEP-12: Development of New Piercing System for Small Holes by Continuous Striking of a Punch Using Ultrasonic Vibration
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In this study, a simple and effective piercing system using ultrasonic vibration was newly developed to produce small holes and micro holes with fine sheared surface. This system consists of two independent units. One is the vibration unit and the other is the piercing unit. A coil spring is placed between the punch and the guide-bush to support the punch in the floating state. When the ultrasonic vibration is transferred to the punch by the UV-horn, it extends out and hits the material, and then