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Cylindrical plunge grinding of twist free surfaces by structured wheels

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The highlights of this investigation is listed as follows:

- Structuring by different status of dressing form roller, including round tip and flattened tip, was simulated by mathematical modeling of the structuring process. It was shown that by varying the dressing parameters, an extensive variety of the structures can be produced on the grinding wheel.
- For the first time, the cylindrical plunge grinding by structured wheels was simulated in this study by the mathematical modeling of the process kinematics. The simulation includes the whole steps of plunging, i.e. during both radial infeed and spark-out time.
- It was shown how the twist is transferred to the workpiece by a structured wheel. The twist can be modelled by the simulation in every step of the process.
- It was found that the ratio of the grinding wheel rotation to the workpiece rotation, n, has a decisive role in grinding of twist free surface. When the parameter "n" is a natural number, the twist remains on the surface even with long time of spark-out. However, by selecting a decimal number for the parameter "n", depending on the grinding parameter, a minimum spark-out time can be calculated through which a twist free surface is ground.
- The experimental results of cylindrical plunge grinding approve the simulation analysis.

Abstract

The high specific energy expended in grinding leads to large heat generation in contact zone of grinding wheel and workpiece, which is the great challenge in the grinding. Aiming to reduce the grinding forces and temperature, employing structured wheels has lately become a subject of special interest. Creation of spiral form structures on the surface of grinding wheels is one of the structuring methods showing great advantages in grinding in terms of grinding force and temperature reduction. However, transfer of the spiral form of the wheel surface to the workpiece surface is a problem with this method. This paper focuses on grinding of twist free surfaces by structured grinding wheels. The kinematics of grinding by the structured wheels was analyzed and simulated with the help of MATLAB. It was found that the ratio of the grinding wheel rotational speed to the workpiece rotational speed plays the key role

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