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Review

A review of the mechanics of metal spinning

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ABSTRACT

This review presents a thorough survey of academic work on the analysis and application of the mechanics of spinning. It surveys most literature published in English and the most important publications in German and Japanese languages. The review aims to provide insight into the mechanics of the process and act as a guide for researchers working on both metal spinning and other modern flexible forming processes.

The review of existing work has revealed several gaps in current knowledge of spinning mechanics: the evolution of the stress state and the strain history of the workpiece in both conventional and shear spinning is not well understood, mainly due to the very long solution times that would occur in modelling the process throughout its duration with a sufficiently fine mesh to capture detailed behaviour through the workpiece thickness; the evolution of microstructure, residual stress and hence springback, has not been examined—either numerically or by experiment; the failure mechanisms of spinning – fracture and wrinkling – are only partially understood, through analogy with other processes, and as yet models of the process have not made use of contemporary damage mechanics; the design of toolpaths required to make particular parts without failure remains an art, and cannot currently be performed automatically with confidence. Studies on novel process configurations in spinning have shown that great potential for innovation in spinning exists. The process has the potential to be more flexible, to produce a wider range of shapes, and to form more challenging materials.

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