# Numerical modelling of metal cutting processes using the Particle Finite Element Method (PFEM) and a physically based plasticity model

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## ABSTRACT

Metal cutting is one of the most common metal shaping processes. Specified geometrical and surface properties are obtained by break-up of the material removed by the cutting edge into a chip. The chip formation is associated with large strain, high strain rate and locally high temperature due to adiabatic heating which make the modelling of cutting processes difficult. Furthermore, dissipative plastic and friction work generate high local temperatures. These phenomena together with numerical complications make modelling of metal cutting difficult. Material models, which are crucial in metal cutting simulations, are usually calibrated based on data from material testing. Nevertheless, the magnitude of strain and strain rate involved in metal cutting are several orders higher than those generated from conventional material testing. Therefore, a highly desirable feature is a material model that can be extrapolated outside the calibration range. In this study a physically based plasticity model based on dislocation density and vacancy concentration is used to simulate orthogonal metal cutting of AISI 316L. The material model is implemented into an in-house Particle Finite Element Method software. Numerical simulations are in agreement with experimental results.

## REFERENCES

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