Towards the Simulation of Internal Traverse Grinding

R. Holtermann†*, S. Schumann*, A. Menzel†‡, D. Biermann*

†Institute of Mechanics, TU Dortmund
Leonhard-Euler-Str. 5, D-44227 Dortmund, Germany
raphael.holtermann@udo.edu, andreas.menzel@udo.edu

‡Division of Solid Mechanics, Lund University
P.O. Box 118, SE-22100 Lund, Sweden
andreas.menzel@solid.lth.se

*Institute of Machining Technology (ISF), TU Dortmund
Baroper Str. 301, D-44227 Dortmund, Germany
schumann@isf.de, biermann@isf.de

Keywords: AISI 52100, cBN, grinding, h-adaptive remeshing, chip formation, finite element method.

ABSTRACT

The present collaborational project work aims at modelling and simulation of Internal Traverse Grinding with focus on the thermomechanical response of the workpiece. This is approached by a hybrid modelling framework consisting of a three-dimensional macroscale workpiece model on the one hand and a mesoscale model focusing on the cutting zone in proximity of a single abrasive particle on the other hand.

For the latter, a thermoelastic viscoplastic constitutive material model is used in a two-dimensional plane strain finite element analysis invoking an adaptive remeshing algorithm to capture material behaviour in the main cutting zone. The input parameters as well as the grain geometries for these analyses are obtained making use of a grinding wheel topography analysis.

Based on experiments carried out, the workpiece scale model is coupled to the mesoscale model, leading to a holistic simulation framework of the grinding process which we aim to develop further in the future. Furthermore, an extension towards a three-dimensional remeshing algorithm as well as multi-grain analyses for the mesoscale model will be focused on in future research.