Determination of Lubricant Bulk Modulus in Metal Forming by Means of a Simple Laboratory Test and Inverse FEM Analysis - DTU Orbit (08/11/2017)

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The influence of workpiece surface topography on friction, lubrication and final surface equality in metal forming operations is well known and has been pointed out by many researchers.This is especially the case when liquid lubricants are applied in situations, where increased surface roughness facilitates the lubricant entrainment, pressurization and possible escape by micro-plasto-hydrodynamic lubrication. In order to model these mechanisms an important lubricant propertyd esignated as the bulk modulus is needed for characterizing the compressibility of the lubricant. The present paper describes a simple, practical test to determine the bulk modulus. Combination of the experimental upsetting of an axisymmetric metal workpiece containing a truncated conical surface pocket with an inverse finite element analysis of the test allows determining the lubricant bulk modulus. The finite element analysis couples lubricant flow with plastic deformation of the metal directly. Results show that the proposed procedure allows determining an approximate bulk modulus for the lubricant.

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