Numerical modelling of microscopic lubricant flow in sheet metal forming. Application to plane strip drawing

This paper presents a numerical investigation of microscopic lubricant flows from the cavities to the plateaus of the surface roughness of metal sheets during forming processes. This phenomenon, called micro-plasto-hydrodynamic (MPH) lubrication, was observed experimentally in various situations such as compression sliding tests, strip drawing and cold rolling. It leads to local friction drop and wear reduction. It is therefore critical to achieve a good understanding of this phenomenon.

To move towards that goal, a multiscale fluid-structure interaction (FSI) model is developed to model lubricant flows at the microscopic scale. These simulations are made possible through the use of the Arbitrary Lagrangian Eulerian (ALE) formalism.

In this paper, this methodology is used to study plane strip drawing. The numerical model is able to predict the onset of lubricant escape and the amount of lubricant flowing on the plateaus. Numerical results exhibit good agreement with experimental measurements.

General information
Publication status: Published
Organisations: Department of Wind Energy, Composites Mechanics and Materials Mechanics, University of Liege, ArcelorMittal Global R&D
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Pages: 203-237
Publication date: 2017
Peer-reviewed: Yes

Publication information
Volume: 112
Issue number: 3
ISSN (Print): 0029-5981
Ratings:
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 2.88 SJR 1.623 SNIP 1.493
Web of Science (2017): Impact factor 2.591
Web of Science (2017): Indexed yes
Original language: English
Keywords: Metal forming, Micro-plasto-hydrodynamic (MPH) lubrication, Finite element method, Liquid lubrication mechanisms, ALE formulation
Electronic versions:
Numerical_modelling_of_microscopic.pdf. Embargo ended: 15/02/2018
DOIs:
10.1002/nme.5509
Source: FindIt
Source-ID: 2351125794
Research output: Contribution to journal › Journal article – Annual report year: 2017 › Research › peer-review