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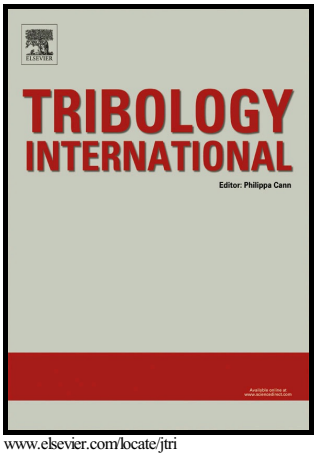

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PII: S0301-679X(16)30400-5
DOI: http://dx.doi.org/10.1016/j.triboint.2016.10.046
Reference: JTRI4439

To appear in: *Tribiology International*

Received date: 24 July 2016
Revised date: 23 October 2016
Accepted date: 25 October 2016

Cite this article as: Y. Carretta, J. Bech, N. Legrand, M. Laugier, J-P. Ponthot and R. Boman, Numerical modelling of micro-plasto-hydrodynamic lubricatio in plane strip drawing, *Tribiology International* http://dx.doi.org/10.1016/j.triboint.2016.10.046

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Abstract

This paper presents a new finite element model capable of predicting the onset of micro-plasto-hydrodynamic (MPH) lubrication and the amount of lubricant escaping from surface pockets in metal forming.

The present approach is divided in two steps. First, a simulation at the macroscopic level is conducted. Then, a second simulation highlighting microscopic liquid lubrication mechanisms is achieved using boundary conditions provided by the first model. These fluid-structure interaction computations are made possible through the use of the Arbitrary Lagrangian Eulerian (ALE) formalism.

The developed methodology is validated by comparison to experimental measurements conducted in plane strip drawing. The effect of physical parameters like the drawing speed, the die angle and the strip thickness reduction is investigated. The numerical results show good agreement with experiments.

Keywords. Metal forming; micro-plasto-hydrodynamic (MPH) lubrication ; Finite element method; Arbitrary Lagrangian Eulerian (ALE) formalism;

1. Introduction

In most sheet metal forming processes, lubricants are used to reduce friction forces involved in the process. Different lubricant regimes take place depending on the operating conditions and the piezo viscous behaviour of the lubricant itself.