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Author: E. Gustafsson M. Oldenburg A. Jansson

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Design and validation of a sheet metal shearing experimental procedure

E. Gustafsson

Dalarna University, SE-781 70 Borlänge, Sweden

M. Oldenburg

Luleå University of Technology, SE-971 87 Luleå, Sweden

A. Jansson

SSAB EMEA AB, SE-781 84 Borlänge, Sweden

Abstract

Throughout the industrial processes of sheet metal manufacturing and refining, shear cutting is widely used for its speed and cost advantages over competing cutting methods. Industrial shears may include some force measurement possibilities, but the force is most likely influenced by friction losses between shear tool and the point of measurement, and are in general not showing the actual force applied to the sheet. Well defined shears and accurate measurements of force and shear tool position are important for understanding the influence of shear parameters. Accurate experimental data are also necessary for calibration of numerical shear models. Here, a dedicated laboratory set-up with well defined geometry and movement in the shear, and high measurability in terms of force and geometry is designed, built and verified. Parameters important to the shear process are studied with perturbation analysis techniques and requirements on input parameter accuracy are formulated to meet experimental output demands. Input parameters in shearing are mostly geometric parameters, but also material properties and contact conditions. Based on the accuracy requirements, a symmetric experiment with internal balancing of forces, is constructed to avoid guides and corresponding friction losses. Finally, the experimental procedure is validated through shearing of a medium grade steel. With the obtained experimental set-up performance, force changes as result of changes in studied input parameters are distinguishable down to a level of one percent.

Keywords: sheet metal, experiment, shearing, cutting, force

1. Introduction

Sheet metal shearing is common within several processing steps in the sheet metal industry, and increased knowledge is desirable in order to improve the processes. Shearing has speed and cost advantages over competing cutting methods

Email address: egu@du.se (E. Gustafsson)