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Experimental study on the effects of clearance and clamping in steel sheet metal shearing

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Abstract

Shear cutting is common within several sheet metal industry processing steps, e.g. in cut to length lines, slitting lines, end cropping. Shearing is fast and cheap relative to competing cutting methods like laser and plasma cutting, but involves large forces on the equipment that increase with increased sheet material strength. Accurate shear experiments are a prerequisite to increase the knowledge of shearing parameters, improve industrial shearing, and provide data for validation of numerical shear models. Here, the two shear parameters clearance and clamp configuration, identified as important to the shear results, were studied in an experimental set-up with well defined tool movement and high measurability of tool position and force. In addition to force measurements, the sheared edge geometry was characterized. Steels of low, medium, and high strength were selected for the study. Throughout the experimental study, the shear tool penetration before fracture decreased with increased material strength. The required shear force decreased and the force attempting to separate the two shear tools increased when one side of the sheet was left unclamped and free to move. Further, the maximum shear force increased with decreased clearance. Clearance changes were small and moreover continuously measured during all shear experiments.

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

1. Introduction

Shearing is a fast and cheap method for sheet metal cutting compared with alternative methods such as laser and plasma cutting. In the sheet metal industry, shear cutting is often used in various processing steps including cut to length, slitting and end cropping. The constant development of sheet metals toward higher strength and formability leads to increased forces on the shear

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